The Graduate Catalog

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A Message from the Dean

An ideal setting for the pursuit of graduate education is one that combines opportunity for in-depth work in a field of specialization with the breadth of experience that large multidisciplinary institutions afford. The University of Maryland provides that opportunity and breadth.

The University is an internationally recognized research university. It is also the most comprehensive institution of higher education, research, and service in the state of Maryland. With over 32,000 students (approximately 8,000 of whom are graduate students) and over 2,800 faculty, it is the primary statewide center for graduate education and research.

The Graduate School offers 87 master's degree programs and 68 doctoral programs which are guided and taught by a community of renowned scholars, researchers, and performing and creative artists. Working independently and together, they offer the committed graduate student virtually unlimited opportunities to excel.

Throughout the history of the Graduate School, our graduates have gone on to distinguished careers in engineering, science, agriculture, the arts and social sciences, business, and education. The University takes pride in its tradition of excellence and in its success in nurturing, challenging, and developing future scholars, researchers, and professionals. The University of Maryland is a scholarly community in which a diversity of ideas, experiences, backgrounds, and perspectives is valued and encouraged.

This Graduate School Catalog provides an overview of the University, its policies, programs, and resources. For additional information, we invite you to visit our web page at http://www.gradschool.umd.edu. You may also contact the individual programs directly. You are cordially invited to visit the campus. Our faculty and staff will be pleased to explore with you the fit between your research interests and career aspirations, and the particular strengths of our programs and faculty.

I look forward to welcoming you.

Chapter 1: Introduction to College Park

The University of Maryland, College Park, the flagship institution of the University of Maryland System, had its origin in 1859 as the Maryland Agricultural College. It became one of the country's first land-grant institutions in 1867. The state assumed authority over the College in 1920 and formed the University of Maryland by joining the College with the long- established professional schools in Baltimore. In 1988, the General Assembly of Maryland designated College Park campus as the flagship institution for the newly-expanded University of Maryland System, which consists of 11 campuses across the state and offers programs at some 200 sites worldwide. As well as pursuing a serious research mission and continuing its high level of service to the state, the University rededicated itself to providing the highest quality graduate and undergraduate education. The University maintains its commitment to students through teaching excellence, exemplary academic resources, and personal attention.

The University of Maryland, College Park, is an internationally recognized research institution offering master's degrees in 80 areas and doctoral degrees in 68. There are over 3,000 faculty members (2,410 full-time), 14 percent of whom are members of minority groups and 31 percent of whom are women. Each year, the University confers nearly 2,000 graduate degrees, approximately 500 of which are doctoral degrees and 1,500 are master's degrees. Of these, 13 percent are earned by minority students and 48 percent are earned by women. The University of Maryland is accredited by the Middle States Association of Colleges and Secondary Schools and is a member of the Association of American Universities. Furthermore, individual colleges, schools, and departments are accredited by a variety of specialized groups and relevant governing bodies.

The Graduate School is committed to creating a scholarly community in which a diversity of ideas, student experiences, individual backgrounds, and perspectives is welcomed and encouraged. As of fall 1996, there are approximately 33,000 students at the University, 8,100 of whom are enrolled in graduate programs. University of Maryland, College Park graduate students come from virtually every state in the Union and 140 foreign nations. Minority students comprise 15 percent of the total student body; 7 percent of our graduate students are African American, 5 percent are Asian American, 2 percent are Hispanic/Latino, and less than 1 percent are American Indian.

Opportunities for conducting research abound at the University of Maryland and in the surrounding area. The dynamic research environment allows students from all disciplines to undertake scholarly exploration of their special interests and gain practical experience. Faculty are able to advance their own expertise and bring their insights with them into the classroom. On campus, special facilities and a number of organized research centers, bureaus, and institutes promote the acquisition and analysis of new knowledge in the arts, sciences, and applied fields.

Location

Nestled on 1,300 acres in the suburban town of College Park, the university is located in the center of the Baltimore-Washington corridor. The university's unique location just 9 miles from downtown Washington, D.C., and approximately 30 miles from both Baltimore and Annapolis enhances the research of its faculty and students by providing access to some of the finest libraries and research centers in the country. Within easy access of the campus are the Library of Congress, Folger Shakespeare Library, National Archives, National Library of Medicine, and National Agricultural Library. In the Baltimore area are the Enoch Pratt Free Library and the Maryland Historical Association Library. The state capital in historic Annapolis houses the Maryland Hall of Records. UMCP is accessible by the METRO rapid transit rail system and bus routes, as well as the MARC commuter trains, all of which have stops in College Park.

Washington, D.C., is rapidly becoming the nation's capital in cultural and intellectual activity as well as political power. The Kennedy Center for the Performing Arts, the Filene Center, and the many fine area theaters regularly present performances by the world's most exciting and renowned artists. The Smithsonian Museums and the National Gallery of Art, among others, sponsor outstanding collections and special exhibits that attract national attention. In addition to cultural activities, the nation's capital provides interested students the opportunity to observe and participate in the work of federal institutions; to sit in the galleries of Congress; to watch the Supreme Court in session; and to attend public Congressional hearings. The possibilities for personal enrichment offered in this exciting cosmopolitan area are indeed enormous.

Outside the metropolitan area and just minutes from the campus, the Maryland countryside is pleasantly rural. Maryland offers a great variety of recreational and leisure activities in its many fine national and state parks, from the Catoctin Mountains in Western Maryland to the Assateague Island National Seashore on the Atlantic-bound Eastern Shore, all within a pleasant drive

from the campus. Recreational and outdoors opportunities in Virginia, Pennsylvania, and Delaware are all within driving distance of campus.

Special Research Resources

The College Park Campus is in the midst of one of the greatest concentrations of research facilities and intellectual talent in the nation, if not in the world. Libraries and laboratories serving virtually every academic discipline are within easy commuting distance. There is a steady and growing exchange of ideas, information, technical skills, and scholars between the university and these centers. The libraries and facilities of many of these centers are open to qualified graduate students. The resources of many more are available by special arrangement.

In the humanities, the Library of Congress and the Folger Shakespeare Library, with its extensive collection of rare manuscripts, are among the world's most outstanding research libraries. In addition, Dumbarton Oaks; the National Archives; the Smithsonian Institution; the World Bank; the National Library of Medicine; the National Agricultural Library; the Enoch Pratt Free Library of Baltimore; the libraries of the Federal Departments of Labor, Commerce, Interior, Health and Human Services, Housing and Urban Development, Transportation, and approximately 500 other specialized libraries are all within a few minutes' drive of the College Park campus. The campus is also the site for the newly constructed National Archives II, the largest archives in the world with the most complete set of records and documents about this nation's history. These resources make the University of Maryland one of the most attractive in the nation for scholars of all disciplines.

The proximity of the Beltsville Agricultural Research Center of the United States Department of Agriculture has stimulated the development of both laboratories and opportunities for field research in the agricultural and life sciences. The National Institutes of Health offer unparalleled opportunities for collaboration in biomedical and behavioral research. Opportunities are also available for collaborative graduate study programs with other major government laboratories, such as the National Institute of Science and Technology, the Naval Research Laboratory, the U.S. Geological Survey, and the Goddard Space Flight Center. The long-standing involvement of the state of Maryland in the development of the commercial and recreational resources of the Chesapeake Bay has resulted in the establishment of outstanding research facilities for the study of marine science at the University of Maryland Center for Environmental and Estuarine Studies, with research facilities at Horn Point near Cambridge, at Crisfield, and at Solomons Island, Maryland.

Campus facilities are excellent for research in every discipline. Work in the behavioral sciences, particularly in learning, is centered in laboratories equipped for fully automated research on rats, pigeons, and monkeys.

Research in the physical sciences includes: superconductivity, smart materials and structures, rotorcraft engineering, material and surface science, laser and optical physics, ion-beam lithography, electronic packaging, novel plasma devices, automation and robotics, advanced computer studies and remote sensing. This research is conducted in laboratories with leading- edge equipment.

Students also have access to research farms, greenhouses, and even laboratory-equipped vessels for research in the Chesapeake Bay. The University also owns and operates one of the world's largest and most sophisticated long-wavelength radio telescopes as part of a three-university consortium known as the Berkeley- Illinois-Maryland Array (BIMA) located at Hat Creek in Northern California.

Since 1951, students and faculty of the University of Maryland, College Park, have benefited from its membership in Oak Ridge Associated Universities (ORAU). ORAU is a consortium of 87 colleges and universities and a management and operating contractor for the U.S. Department of Energy located in Oak Ridge, Tennessee. ORAU works with its member institutions to help their students and faculty gain access to federal research facilities throughout the country; to keep its member informed about opportunities for fellowship, scholarship, and research appointments; and to organize research alliances among its members.

Through the Oak Ridge Institute for Science and Education, the DOE facility that ORAU manages, undergraduates, graduates, postgraduates, as well as faculty enjoy access to a multitude of opportunities for study and research. Students can participate in programs covering a wide variety of disciplines including business, earth sciences, biomedical sciences, nuclear chemistry, and mathematics. Appointment and program length range from one month to four years. Many of these programs are especially designed to increase the numbers of underrepresented minority students pursuing degrees in science- and engineering-related

disciplines. A comprehensive listing of these programs and other opportunities, their disciplines, and details on locations and benefits can be found in the ORAU Resource Guide.

Distinguished Faculty

The University of Maryland, College Park is committed to hiring and retaining the best faculty possible. Listed here are some of the distinguished faculty in residence at Maryland. The title of Distinguished University Professor is the highest honor that the University bestows upon a member of its faculty. Distinguished University Professors are recognized for their exceptional accomplishments in scholarship and teaching and for their contributions to the University. The Distinguished Scholar-Teacher program, established in 1978, honors a small number of faculty members who have demonstrated notable success in both scholarship and teaching. By honoring the Distinguished Scholar-Teacher with this prestigious award, we reaffirm our commitment to excellence in teaching and scholarship. The Distinguished Scholar-Teach Program is sponsored by the Office of Academic Affairs and Administered by the Associate Provost for Faculty Affairs.

Libraries

Tithe Libraries on the College Park campus contain over 2.3 million volumes and subscribe to some 26,000 periodicals and newspapers. Additional collections of research materials are available on microfilm, microfiche, phonograph records, tapes, films, and in electronic formats.

The Theodore R. McKeldin Library is the largest library on campus and the principal library for graduate use in the humanities, social sciences, agriculture, and life sciences. Special collections and research materials include the papers of former Vice President Spiro T. Agnew, Romeo Mansueti, Katherine Anne Porter, and Djuna Barnes; the archive of the Association for Intercollegiate Athletics for Women; the photo archives of the Baltimore News-American; Maryland documents; and the files of the Industrial Union of Marine and Shipbuilding Workers of America and other labor unions. The University Libraries are also a regional depository of U.S. Government publications; the Government Documents/Maps Room in McKeldin includes these U.S. Government publications and maps, as well as documents of the United Nations, the League of Nations and other international organizations, and maps from the U.S. Army Map Service. McKeldin also houses the collection of the National Trust for Historic Preservation Library.

The Gordon W. Prange Collection, one of the world's largest repositories of published and unpublished Japanese-language materials from the Allied Occupation period, is housed in McKeldin Library and consists of Japanese newspapers, monographs, periodicals, pamphlets and newsletters, textbooks, maps, news photographs, and political posters produced primarily in the period 1945 to 1949, a time of Allied civil censorship controls. The materials range from children's books and women's magazines to business, scientific and technical publications. The collection is especially rich in fiction and poetry, including reprints and first editions. These rare manuscript materials have attracted scholars from around the world and have been utilized frequently in recent Japanese and Western scholarship on post- World War II Japan. They are complementary to the American government documents which are housed in National Archives II adjacent to the College Park campus. The East Asia Collection, available since the mid-1960's, includes Japanese, Korean, and Chinese language monographs, periodicals, and newspapers. It currently contains about 74,000 catalogued items, and is particularly strong in scholarly works on the humanities and behavioral and social sciences and in reference and serial publications. With the exception of the Japanese Division of the Library of Congress, this is the largest East Asian language collection to be found in any academic institution in the tri- state region of Delaware, Maryland, and Virginia.

Graduate students at UMCP are not served by McKeldin alone; the UMCP Libraries system also includes six branch libraries. Although the Hornbake Library's collection of books, periodicals, reserves, and other materials is primarily for the undergraduate student, this library does offer ample study space and a 24-hour study room during fall and spring semesters as well as a room serving persons with disabilities. Hornbake also houses Nonprint Media Services, the central location for audio-visual materials in the library system and the campus, and the Music Library with books, periodicals, music scores and parts, and recordings in both music and dance. The Music Library's special collections include items from the American Bandmasters Association Research Center, the National Association of College Wind and Percussion Instructors Research Center, the International Clarinet Society Research Library, and the International Piano Archives at Maryland. The National Public Broadcasting Archives, dealing with the history and development of public broadcasting, and the Library of American Broadcasting are also housed in Hornbake Library.

The Engineering and Physical Sciences Library (EPSL) contains materials in physics, engineering, mathematics, and geology with other significant collections in computer science, environmental sciences, water resources, and aerospace science. EPSL is also a U.S. patent and trademark depository library and its large Technical Reports Center contains collections from NASA, ERDA, Rand Corporation, and other agencies and organizations.

The Charles E. White Memorial (Chemistry) Library is a collection of chemistry, biochemistry, and microbiology materials. Materials include books, periodicals, major indexes, and comprehensive spectra collections.

Architecture students are served by the Architecture Library with materials on architectural design, theory and history, urban design, landscape architecture, and building technology. This library's special collections include rare architecture books dating as far back as the seventeenth century with materials on world expositions from 1851 to 1937.

For art students, the Art Library collects materials in art history, studio art, art education, photography, graphic arts, interior design, and textiles. Special collections include art reproductions and art exhibition catalogs.

Research is supported in the UMCP Libraries with a variety of technological tools. The online catalog (VICTOR) identifies library materials from the collections of libraries on all campuses in the University of Maryland System. Access to this information is available through public terminals located throughout the library systems and through network and telephone connections using terminals in homes or offices, as well as libraries around the country. It also offers information about articles in over 16,000 journals through the UNCOVER file. VICTOR also provides links to hundreds of other library catalogs and databases including 150 files offered by DIALOG, a major database vendor. Research is also supported through the fee-based CARS (Computer Assisted Reference Services) for accessing hundreds of remote bibliographic, textual and numeric databases, as well as through the free use of over 60 automated reference tools in the libraries. The newly opened Electronic Reading Room further enhances the advanced research tools available to all students, faculty, and staff. UMCP's libraries are constantly updating their available technology resources.

In the McKeldin, Hornbake, White Memorial, and Engineering and Physical Sciences Libraries, library users can run their own computer searches utilizing a variety of dial-in services and CD-ROMs for information in education, social sciences, life sciences, business and patents. In conjunction with the Computer Science Center, ESPL and Hornbake Libraries offer microcomputers for the use of anyone in the UMCP community.

Research is also supported through a variety of user consultation services, including directional assistance, basic reference help and in-depth consultations for complex information problems. Such help may be requested at the reference desk of any of the libraries.

Borrowing library materials is aided by several services in addition to basic circulation assistance. Direct borrowing privileges at the other University of Maryland System libraries are available for registered UMCP graduate students. Inter-Library Loan services are available through McKeldin Library's ILL office to obtain loans or photocopies of materials from other libraries that are not available at UMCP.

Special Opportunities for Artists

Advanced work in the creative and performing arts at College Park is concentrated in the Tawes Fine Arts Building and the Art-Sociology Building. The Maryland Center for the Performing Arts, currently under construction, will provide approximately 318,000 square feet of modern classrooms, laboratories, studios, practice rooms, offices, a library, performance halls and theaters. Creative work is greatly stimulated by the close interaction that has developed between the students and faculty of the university and the artists and scholars at the National Gallery, the Corcoran Gallery, the Hirshhorn Museum, the Phillips Gallery, the Smithsonian Institution, as well as the musicians of the National Symphony Orchestra, the Baltimore Symphony Orchestra, and small musical groups. The Kennedy Center for the Performing Arts and the Filene Center (Wolf Trap Farm Park) have further enhanced the climate for creative artists attending the university.

Outstanding work on campus in theater, dance, radio, and television is aided by the proximity of the campus to the National Theater, the Arena Stage, the Morris Mechanic Theater and numerous little theater groups in the Washington and Baltimore area. There is a frequent and steady exchange of ideas and talent between students and faculty at the University with

educational and commercial radio and television media, as a consequence of the large professional staffs that are maintained in the Washington area.

Accreditation

The University of Maryland is accredited by the Middle States Association of Colleges and Secondary Schools and is a member of the Association of American Universities. Individual graduate programs may be accredited by their appropriate agencies. Check with the graduate program of your interest for particular accreditations.

Chapter 2: Admission to Graduate School

Responsibility for admitting applicants to graduate programs rests with the Dean of the Graduate School. Academic department and program offices review admissions applications and credentials and make admissions recommendations to the Graduate Dean. In cases where credentials were earned abroad, the staff of the International Education Services Office is consulted. the standards maintained by the Graduate School and individual departments and programs are applied to ensure that applicants admitted to the University are well qualified and trained to study at this institution and have a reasonable expectation of successfully completing a graduate program. Standards for admission to doctoral degree programs are frequently higher than those for admission to master's degree programs. In many degree programs, the number of applications received from qualified applicants for graduate study regularly exceeds the number of applicants who can be accommodated. In such cases, only the most highly qualified are offered admission. The number of spaces available in various departments is limited according to the availability of faculty, special resources and funds for students requiring financial assistance.

Criteria for Admission

Those applicants who have earned or will earn a bachelor's degree at a regionally accredited college or university in the United States, or the equivalent of this degree in another country, will be considered for admission to the Graduate School at the University of Maryland.

The decision to admit an applicant to a program is based primarily on a combination of the following criteria according to the requirements of the specific graduate program. An applicant can matriculate in only one graduate program for a specified objective.

Quality of previous undergraduate and graduate work. The Graduate School requires as a minimum standard a B average or 3.0 on a 4.0 scale, in a program of study resulting in the award of a baccalaureate degree from a regionally accredited college or university. If an applicant has studied at the graduate level elsewhere, less weight may, but not necessarily will, be placed on the quality of the undergraduate academic record. Some programs may require a higher minimum grade point average for admission.

Strength of letters of recommendation from persons competent to judge the applicant's probable success in graduate school. These letters are usually from the applicant's former professors who are able to give an in-depth evaluation of the applicant's strengths and weaknesses with respect to academic work. Additional recommendations may come from employers or supervisors who are familiar with the applicant's work experience. Applicants should instruct their references to send all letters of recommendation directly to the program to which they are applying.

Scores on a nationally standardized examination. The three most widely used standardized examinations are the Graduate Record Examination (GRE), the Graduate Management Admissions Test (GMAT) and the Miller Analogies Test (MAT). Because the predictive utility of these test scores may vary from one group of applicants to another, a discriminating use of all relevant materials will be made in each applicant's case. For additional information, please refer to the section of the Catalog entitled "Standardized Test Scores."

Statement by the applicant of academic career objectives and their relation to the intended program of study. These statements help the department or program identify students whose goals are consonant with its objectives.

Other evidence of graduate potential. Some programs require other evidence of graduate potential, such as a portfolio of creative work, completion of specialized examinations, personal interviews, or an example of scholarly work.

Eligibility for Admission

Prospective students may apply for admission to the University of Maryland, College Park, during or after their final year of undergraduate study but must furnish proof of graduation before the end of their first semester of enrollment at the University.

Prospective students applying for admission to a graduate degree program in a field of specialization in which they already hold that same degree or its equivalent may do so only if the previous degree program was of substantially different character or was not accredited.

Prospective Summer-only Students applying for entrance in either of the two summer sessions should check the Summer Sessions Bulletin to determine if the courses they wish to take will be offered. To obtain this publication, write to the Office of Continuing Education, Summer and Special Programs, 2103 Reckord Armory, University of Maryland, College Park, MD 20742-5321.

(a) Non-U.S. Citizens (i.e., legal permanent residents of the U.S. and/or immigrants). To assure full consideration, all documents not written in English must be accompanied by a literal English translation and submitted least six months prior to the first day of classes of the semester for which the applicants are seeking admission.

(b) International applicants (i.e. applicants who are not permanent residents of the U.S. and/or immigrants) may obtain an application for admissions from the Office of Graduate Admissions, 2117 Lee Building, the Graduate School, University of Maryland, College Park, MD 20742-5121. To assure full consideration, applicants with foreign credentials must submit academic records in the original language with literal English translations.

Categories of Admission to Degree Programs

Applicants for degree programs may be admitted to either full or provisional status as outlined below:

Full Graduate Status

Students admitted to full graduate status must have submitted official documents indicating a completed baccalaureate degree from a regionally accredited institution and be otherwise fully qualified in the judgment of the individual program and the Graduate School.

Provisional Graduate Status

Students may be admitted to provisional status because:

- the previous academic record is borderline; or
- the prerequisite course work in the chosen field is insufficient; or
- the applicant has majored in another field with a creditable record but has not yet clearly demonstrated abilities in the proposed new field; or
- the applicant has not provided official copies of information required by the graduate program or the Graduate School. For example, the applicant has completed the baccalaureate degree and/or the master's degree but has not yet submitted official verification of the last semester's work and receipt of the degree.

Official transcripts indicating receipt of the degree must be submitted before the end of the first semester.

Non-degree Admission Categories

Advanced Graduate Specialist Certificate Status

The Advanced Graduate Specialist Program is designed to promote a high level of professional competence in an area of specialization in the field of education. The candidate must be able to demonstrate that he or she can operate as an effective counselor, administrator, teacher or skilled person in a major field of professional endeavor. The Advanced Graduate Specialist Certificate is offered through most of the programs in the College of Education. The Certificate is awarded by the College of Education. Requirements are as follows:

> Applicants must meet the same general criteria for admission as those prescribed for degree seekers. Additionally, the applicant must have completed a master's degree or the equivalent in credits earned either at the University of

Maryland or at another regionally accredited institution. The Miller Analogies Test or the Graduate Record Examination scores are required at the time of application.

Course work totaling not more than 30 credits with grades of at least a "B" from an accredited institution may be transferred to the program at the University..

The program must be developed in cooperation with an advisor and filed with the Graduate Studies Office in the College of Education.

The Advanced Graduate Specialist Certificate program requires a minimum of 60 semester hours of credit with not less than 30 semester hours of credit completed with the University of Maryland. At least one half of the credits earned either at other institutions or at the University of Maryland must be in courses comparable to those in the 600-800 series. The student may be required to take a substantial portion of the program in departments other than those in the College of Education. Registration in certain kinds of field study, field experience, apprenticeship or internship may also be required.

There will be a written examination of not less than six hours. A "B" average with no "D" or "F" grades will be required before the certificate can be awarded.

For additional details see "A Guide for Student Advisors issued by the College of Education Graduate Studies Office, Room 1210, Benjamin Building, University of Maryland, College Park, MD 20742-1121.

Advanced Special Student Status

The Advanced Special Student Status is designed to provide an opportunity for individuals who do not have an immediate degree objective to take graduate level courses. Although the primary mission of the Graduate School is to conduct programs of graduate instruction leading to advanced degrees, the Graduate Faculty welcomes qualified students who have no degree objectives, to the extent that resources allow. Unofficial transcripts or photocopies of diplomas will be accepted with the application for evaluation purposes, but the student must submit official copies of all required documents before the end of the first semester of enrollment. Official transcripts must be submitted from all institutions except the University of Maryland, College Park.

Applicants for admission to Advanced Special Student Status must **hold a baccalaureate degree from a regionally accredited institution and satisfy one of the following criteria**:

Have an overall "B" (3.0) average. Applicants must submit official transcripts covering all credits used in satisfying the baccalaureate degree requirements.

Hold a master's or doctoral degree from a regionally accredited institution. Applicants must submit an official transcript showing the award of a master's or doctoral degree.

Have at least four years of successful post-baccalaureate work or professional experience. Applicants must submit an official transcript showing the award of the baccalaureate degree.

Achieve a score that places the applicant in the upper 50th percentile of appropriate national standardized aptitude examinations such as the Graduate Record Examination Aptitude Test, the Miller's Analogies Test, the Graduate Management Admissions Test. Where different percentiles are possible, the Graduate School will determine which score is acceptable.

Admission to Advanced Special Student Status will continue for **five years**. If there is no registration in **three consecutive academic semesters**, the admitted status will lapse and a new application will be required.

Advanced Special Students **must maintain a 2.75 grade point average**.

Advanced Special Students must pay all standard graduate fees. Students in this status are not eligible to hold appointments as Graduate Teaching or Research Assistants or Fellows, or receive other forms of financial aid. All other services (e.g., parking, library privileges) are the same as those accorded to other graduate students.

Admission to Advanced Special Student Status is not intended to be used as a preparatory program for later admission to a doctoral or master's program or to the Advanced Graduate Specialist Certificate program. Successful completion of Advanced Special Student courses does not guarantee admission to a graduate degree or certificate program. Each program may accept Advanced Special Student courses in satisfaction f program requirements to a maximum of twelve (12) credits. This is contingent on admission to the degree or certificate program and on the approval of the faculty in the program. For consideration of admission to a degree program at a later time, the student must submit a new application. See the Transfer Credit section below for more information.

Visiting Graduate Student Status

A graduate student matriculated in another graduate school who wishes to enroll in the Graduate School of the University of Maryland, College Park and who intends to return to the graduate school in which he or she is matriculated, may be admitted as a Visiting Graduate Student.

Graduate students at institutions other than the University of Maryland, College Park, who wish to enroll in the Graduate School and intend to return to their home institutions may be admitted as Visiting Graduate Students. To apply, the applicant must submit a completed application form and the application fee to the Graduate Admissions Office. Transcripts, letters of recommendation and test scores are not required. In lieu of transcripts, the applicant must submit a letter from the graduate dean at the applicant's institution confirming that the applicant is in good academic standing and that courses taken at the University of Maryland will be transferred to the home institution.

Golden Identification Card for Senior Citizens of Maryland

The purpose of this status is to make the University's services and courses available without charge to citizens who are 60 years of age or older, who are residents of the State of Maryland and who are retired. (Retired persons will be considered those who affirm that they are not engaged in gainful employment for more than 20 hours per week.) People meeting these requirements may apply for graduate admission either as degree or non-degree students, and they must meet the same admissions criteria pertaining to either category as do all applicants. Once admitted and issued the Golden Identification Card, senior citizens may register for courses in any session, subject to the same restrictions as any other student, and use the library and other campus facilities during the time they are enrolled in courses. Tuition fees will be waived for Golden Identification Card holders.

Admission to an Institute

Application for admission to an institute should be made directly to the director of the institute. If admission to the Graduate School is also necessary, the decision will be based on the same criteria for admitting other degree applicants. Admission to an institute does not imply that the individual will be automatically admitted in any other status at the University of Maryland at a later date. The status terminates upon completion of the institute in which the student is enrolled. A new application must be submitted for admission to any other graduate status or program.

Students already admitted to a regular graduate degree or non- degree status may also qualify for participation in an institute.

Offer of Admission

Applicants admitted to the Graduate School will receive a written offer of admission from the Graduate School specifying the date of entrance. The offer of admission requires a response. If the applicant wishes to accept, decline or change the effective date of the offer, the Graduate School must be notified or the offer of admission becomes void. Failure to register for the authorized semester also voids the offer of admission. If the offer is voided, the applicant must submit another application and may be required to submit additional credentials in order to be considered for admission in a subsequent semester.

Graduate students must consult their graduate program for precise registration information.

Change of Status or Program

Students are admitted only to specified programs for specified objectives. New applications are required under the following conditions:

1. If the student wishes to change programs (students may be admitted to only one graduate program at any one time); or
2. If the student wishes to change status (from non-degree to degree); or
3. If the student wishes to pursue a new degree objective (change from master's to doctoral degree).

Admission to a new program and/or status is not granted automatically. Each application is subject to approval.

Termination of Admission Status

A student's admission terminates when the time limits for completion of the degree or non-degree status have been exceeded or when the student is no longer in "good standing." Degree- seeking students must maintain a 3.0 grade point average (GPA) for all graduate courses taken since enrollment in the degree program and must otherwise satisfy all additional graduate program and Graduate School requirements. Non-degree seeking students must maintain an overall GPA of 2.75. The admission of all students, both degree and non-degree, is continued at the discretion of the graduate director of the program and the Dean of the Graduate School, consistent with the policies and practices of the Graduate School and graduate program.

The Admission Process

To be considered for admission to the Graduate School, each applicant must obtain and complete the application form. An application may be obtained by writing directly to the Office of Graduate Admissions, 2117 Lee Building, University of Maryland, College Park, MD 20742-5121. Graduate Admissions can also be contacted by phone (301) 405-4198, fax (301) 314-9305, E-mail: grschool@deans.umd.edu, or through our World Wide Web site at the following address: http://www.gradschool.umd.edu/Admit/index.html. Several Online versions of the Graduate Application are also available on the World Wide Web.

Each applicant must submit the following items to the Office of Graduate Admissions:

1. A completed application form. (Original copy to the Graduate School with a copy to the graduate program. If using the electronic application, please follow the instructions on the website.
2. A non-refundable application fee of $50.00.
3. Two complete sets of transcripts reflecting all undergraduate and graduate work elected or in progress. Each transcript must bear the signature of the registrar and the seal of the granting institution and should include the years of attendance, courses taken, grades received, class standing and the degree, certificate or diploma received. If the applicant attended the University of Maryland, the Graduate School will obtain your records of courses completed on the College Park campus. To facilitate the processing and review of an application, send two sets of unofficial copies of transcripts from institutions other than the University. Official copies of those transcripts are required before full admission can be granted.
4. Three letters of recommendation submitted by professors or others who can assess the quality of the applicant's academic performance and scholastic potential. Letters of recommendation should be sent directly to the academic program in which the applicant is interested. Be certain that the applicant's full name is included on each recommendation.
5. Statement of Goals. Each applicant must prepare a 300-500 word statement of his or her goals and objectives in pursuing graduate study.
6. Standardized Test Scores. Many graduate programs require applicants to submit scores of standardized examinations, such as the Graduate Record Examination (GRE), the Graduate Management Admission Test (GMAT) or the Miller Analogies Test (MAT). To determine if one of these examinations is required for admission to the program to which you are applying, please consult the program listing in the application brochure. If standardized test scores are required, you may write to the following addresses for further information:

Graduate Record Examinations
Educational Testing Services
P.O. BOX 6000
Princeton, NJ 08541-6000 USA
(609) 771-7670

Graduate Management Admissions Test
Educational Testing Services
P.O. Box 6103
Princeton, NJ 08541-6103 USA
(609) 921-9000

Miller Analogy Test
Psychological Corporation
555 Academic Court
San Antonio, TX 78204
1-800-228-0752

Examination scores should be sent directly to the graduate program to which the applicant is applying. the University of Maryland, College Park institutional code for the GRE and GMAT is 5814.

7. Graduate Program Requirements. Some graduate programs require additional information such as a portfolio or other supplementary materials. It is important that applicants contact the graduate program to which they are applying for information concerning additional admission requirements. Failure to do so may result in an application not being considered. Should the application and fee arrive past the stated deadline date, the application will automatically be considered for the next admissible semester.

Calculation of Grade Point Average

All applicants must calculate separate grade point averages for the following categories: (1) all courses taken for the baccalaureate; (2) all credits earned after the first 60 credits for the baccalaureate; (3) credits that constitute the undergraduate major; and (4) all credits taken beyond the bachelor's degree. All grades are to be converted to a four- point grading system. Pass/fail, satisfactory, completed credit and similar grades are not included in these calculations. Except as already noted, all numerical, alphabetical or equivalent grades must be calculated as follows:

a) Multiply quarter credit hours by (.66) to convert to semester credit hours.
b) Multiply the number of semester credit hours for each course by the number of quality or honor points earned, as follows: A=4; B=3; C=2; D=1; F=O. If the applicant attended an institution that assigned quality points to represent + or - grades, he or she should utilize such information in computing his or her GPA.
c) Divide the total number of quality points by the total number of semester credit hours. The quotient will be your grade point average.

Application Status Check

Because we receive thousands of applications each year, it is important and to the applicant's benefit to send a complete application package and fee well before the stated deadline date. Once applicants have sent the materials to both the Graduate Admissions Office and the graduate program(s) to which they are applying, they may check the status of the application by calling our 24-hour Graduate Application Inquiry Voice Response System from a touch tone phone, (301) 403-0554, or by accessing this feature on the World Wide Web by going to Testudo at http://www.testudo.umd.edu.

Admission of Faculty

No member of the faculty who is employed by the University of Maryland, College Park, and has the rank of assistant professor or above is permitted to enroll in a program leading to an advanced degree in his or her academic college or school. A faculty member who wishes to take course work for personal enrichment in his or her academic college or school may choose to investigate the Advanced Special Student status. A faculty member who wishes to pursue an advanced degree in a graduate

program outside of his or her academic college or school may do so by obtaining written permission from the Dean of the Graduate School, subsequent to obtaining written consent from the Deans of both the academic college/school in which he or she is employed and from which he or she seeks a degree.

Application Deadlines

Applicants should pay special attention to the deadlines listed in the most current application booklet. It is generally to the applicant's advantage to apply well before the published deadline, particularly if the applicant wishes to be considered for fellowships, assistantships or other forms of financial aid. The Graduate School strongly recommends that applicants time the submission of their applications, transcripts, and letters of recommendation to arrive well before the published deadline dates. Applicants are solely responsible for making certain their transcripts have been received by the Graduate School and by the graduate program(s) to which they apply.

If possible, the application should arrive before the transcripts and other supporting evidence of preparation, if these materials cannot be attached to the application. Application deadline information for the Fall and Spring Semesters is listed below:

1. Domestic students. Each graduate program, in consultation with the Graduate School, sets its own deadlines for Fall and Spring semester entrances for U.S. citizens, resident aliens, and refugees.
2. International Students. Non-U.S. residents or those who require transcripts from non-U.S. institutions must submit applications for admission by the following dates:

    Fall - February 1 of prior academic year (unless the graduate program in which you are interested sets an earlier deadline).

    Spring - June 1 of prior academic year (unless the graduate program in which you are interested sets an earlier deadline).

Summer School

Students applying for entrance in either of the two summer sessions are urged to check the Summer Sessions Bulletin to determine if the courses they wish to take will be offered in a particular session. To obtain this publication, write to the Office of Continuing and Extended Education, 2103 Reckord Armory, University of Maryland, College Park, MD 20742- 5321.

International Students

International applicants seeking admission to University of Maryland, College Park should not plan to leave their country before receiving an official offer of admission from the Graduate School.

1. All citizens of foreign countries must submit applications for admission in accordance with stated deadlines. (See above.)
2. Special Notes for International Students:
    a. Academic Credentials: To assure full consideration, complete application and official transcripts or mark sheets in the original language with literal English translations should be received in the Graduate Admissions Office prior to stated deadlines.
    b. English Proficiency: Applicants must demonstrate English language proficiency by taking the Test of English as a Foreign Language (TOEFL) since all international students are expected to read, speak, understand and write English fluently. International applicants who wish to be considered for a teaching assistantship may be required to take the Test of Spoken English (TSE).
    c. Financial Resources: Each applicant must furnish a statement of financial status to the Office of International Education Services (IES). the amount required for tuition and living expenses each year will be indicated in the Graduate Application.
    d. Immigration Documents: IES will issue to applicants admitted for graduate study the forms necessary to obtain appropriate student immigration status.
    e. International applicants should address any questions to International Education Services, 3117 Mitchell Building, University of Maryland, College Park, MD 20742-5215, USA (301- 314-7740).

Every foreign student is expected to report to the Office of International Education Services as soon as possible after arrival at the University. This Office will be able to assist not only with various problems regarding immigration, housing and fees, but

also with problems relating generally to orientation to university and community life. Questions concerning criteria and requirements for international applicants should be addressed to International Education Services, 3117 Mitchell Building, University of Maryland, College Park, MD 20742-5215 (301-314-7740).

Records Maintenance and Disposition

All records, including both standardized test scores and academic records from other institutions, become part of the official file and can neither be returned nor duplicated for any purpose. Students should retain an additional copy of their official credentials to keep in their possession for advisory purposes and for other personal requirements.

the admission credentials and the application data of applicants are retained from the date of receipt for 12 months only and then destroyed in the following cases: 1) Applicants who do not register for courses at the time for which they have been admitted; 2) Applicants whose applications have been disapproved; 3) Applicants who do not respond to graduate program requests for additional information; and 4) Applicants whose applications are not complete with respect to the inclusion of all transcripts or test results.

Immunization

the University of Maryland requires all freshmen, new graduate and transfer students to provide documentation of Measles, Mumps, Rubella, and Tetanus / Diphtheria. It is a student's responsibility to provide this information to the Health Center before school begins. This requirement is mandatory.

Chapter 3: University of Maryland Policy Statements

Disclaimer

The provisions of this publication are not to be regarded as an irrevocable contract between the student and the University of Maryland. Changes are affected from time to time in the general regulations and in the academic requirements. There are established procedures for making changes that protect the institution's integrity and the individual student's interest and welfare. A curriculum or graduation requirement, when altered, is not made retroactive unless the alteration is to the student's advantage and can be accommodated within the span of years normally required for graduation. When the actions of a student are judged by competent authority, using established procedure, to be detrimental to the interests of the university community, that person may be required to withdraw from the university.

**Deadlines, tuition, fees, and availability of courses are subject to change from year to year. Students are advised to check with the graduate program for the most up-to- date information.*

Non-Discrimination

The University of Maryland is an equal opportunity institution with respect to both education and employment. The University does not discriminate on the basis of race, color, religion, national origin, sex, age, or handicap in admission or access to, or treatment or employment in, its programs and activities as required by federal and state laws and regulations. Inquiries regarding compliance with Title VI of the Civil Rights Act of 1964, as amended, Title IX of the 1972 Educational Amendments, Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act of 1990, or related legal requirements should be directed to:

Director

Office of Human Relations

1107 Hornbake Library

University of Maryland

College Park, MD 20742

Telephone: (301) 405-2838

Inquiries concerning the ADA application of Section 504 to the University of Maryland, College Park, Maryland, may be directed to:

Director

Disability Support Service

0126 Shoemaker Hall

University of Maryland

College Park, MD 20742

Telephone: 314-7682 (voice) or 314-7683 (TTY)

In addition to the University's statement of compliance with federal and state laws, the University Human Relations Code notes that the University of Maryland affirms its commitments to a policy of eliminating discrimination on the basis of race, color, creed, sex, sexual orientation, marital status, personal appearance, age, national origin, political affiliation, physical or mental disability, or on the basis of the exercise of rights secured by the First Amendment of the United States Constitution.

(Complete texts of the University Human Relations Code and the Campus Policies and Procedures on Sexual Harassment are printed in the Appendices to this catalog).

Academic Integrity

The University of Maryland is an academic community dedicated to teaching, learning, and research. Like other communities, the University can function properly only if its members share an expectation of intellectual honesty. Academic integrity promotes the development and expression of new ideas, while academic dishonesty acts as a corrosive force in the life of the university. Academic integrity enhances the quality of each student's education and allows for the recognition of the genuine achievements and accomplishments of all.

By enrolling at the University of Maryland, students acknowledge their obligation to adhere to the Code of Academic Integrity. As members of the University community, students are responsible for promoting academic integrity. This includes the responsibilities to report cases of academic dishonesty to the Student Honor Council and to cooperate with faculty and the Council in resolving such cases.

Appendices

A.	**Policy for Student Residency Classification for Admission, Tuition and Charge-Differential Purposes**	Residency Classification Office
B.	**Academic Integrity**	University of Maryland Policies and Procedures, Office of Legal Affairs III-1.00 POLICY ON FACULTY, STUDENT AND INSTITUTIONAL RIGHTS AND RESPONSIBILITIES FOR ACADEMIC INTEGRITY III-1.00(A) UMCP CODE OF ACADEMIC INTEGRITY
C.	**Code of Student Conduct and Annotations**	University of Maryland Policies and Procedures, Office of Legal Affairs V-1.00(B) UMCP CODE OF STUDENT CONDUCT
D.	**Human Relations Code**	University of Maryland Policies and Procedures, Office of Legal Affairs VI-1.00(B) UNIVERSITY OF MARYLAND HUMAN RELATIONS CODE
E.	**Campus Policy and Procedures on Sexual Harassment**	University of Maryland Policies and Procedures, Office of Legal Affairs VI-1.20 UNIVERSITY OF MARYLAND SYSTEM POLICY ON SEXUAL HARASSMENT VI-1.20(A) UNIVERSITY OF MARYLAND POLICY AND PROCEDURES ON SEXUAL HARASSMENT VI-1.30 UNIVERSITY OF MARYLAND SYSTEM POLICY ON SEXUAL ASSAULT VI-1.30(A) UMCP PROCEDURES ON SEXUAL ASSAULT
F.	**UMCP Graduate Policy and Procedures for Review of Alleged Arbitrary and Capricious Grading**	University of Maryland Policies and Procedures, Office of Legal Affairs III-1.20 POLICY FOR REVIEW OF ALLEGED ARBITRARY AND CAPRICIOUS GRADING III-1.20(A) UMCP PROCEDURES FOR REVIEW OF ALLEGED ARBITRARY AND CAPRICIOUS GRADING--GRADUATE STUDENTS
G.	**University of Maryland at College Park Policy on Copyrights and Patents**	University of Maryland Policies and Procedures, Office of Legal Affairs IV-2.20 POLICY ON CLASSIFIED AND PROPRIETARY WORK IV-3.00 POLICY ON PATENTS IV-3.00(A) UMCP PROCEDURES ON PATENT AND TECHNOLOGY TRANSFER IV-3.10 POLICY ON COPYRIGHTS

H.	**Class Exercises That Involve Animals**	Testudo: Schedule of Classes
I.	**Animal Care and Use Program**	Animal Care and Use Committee
J.	**Research Involving Human Subjects**	University of Maryland Policies and Procedures, Office of Legal Affairs IV-2.10 UNIVERSITY OF MARYLAND SYSTEM POLICY ON HUMAN SUBJECTS OF RESEARCH
K.	**Guidelines for Combined Bachelor's/Master's Programs**	University of Maryland Policies and Procedures, Office of Legal Affairs III-2.20(A) UMCP POLICY AND GUIDELINES FOR COMBINED BACHELOR'S/MASTERS PROGRAMS
L.	**Inter-Institutional Registration**	University of Maryland Policies and Procedures, Office of Legal Affairs III-2.41 POLICY ON GRADUATE STUDENT INTER-INSTITUTIONAL REGISTRATION
M.	**University Policy on Disclosure of Student Records**	University of Maryland Policies and Procedures, Office of Legal Affairs III-6.30 POLICY ON CONFIDENTIALITY AND DISCLOSURE OF STUDENT RECORDS III-6.30(A) UMCP POLICY AND PROCEDURES ON THE DISCLOSURE OF STUDENT EDUCATION RECORDS
N.	**Immunization Policy**	University of Maryland Policies and Procedures, Office of Legal Affairs V-1.00(H) UMCP IMMUNIZATION POLICY
O.	**Policy on Student Alcohol and Other Drug Abuse**	University of Maryland Policies and Procedures, Office of Legal Affairs VI-8.00(B) UMCP POLICY ON STUDENT ALCOHOL AND OTHER DRUG ABUSE
P.	**Smoking Policy and Guidelines**	University of Maryland Policies and Procedures, Office of Legal Affairs X-5.00(A) UMCP SMOKING POLICY AND GUIDELINE

Chapter 4: Graduate Programs

Addiction Science and Interventions (Z097)

Abstract

The Graduate Certificate Program in Addiction Science and Interventions is designed for behavioral health professionals seeking specific expertise and credentialing for improved clinical service to addictions/substance using populations. Professionals will gain (1) foundational knowledge from the scientific literature on addictions, (2) cutting-edge, evidence-based intervention and assessment knowledge and skills, and (3) a critical perspective on the systemic and socio-cultural issues related to addictions/substance use. The Graduate Certificate Program in Addiction Science and Interventions is a fully online program offered through the Center for Addictions, Personality, and Emotion Research in the Department of Psychology at the University of Maryland.

The program includes didactic instruction in (1) Introduction to addictions and co-occurring conditions, (2) Assessment of addiction, (3) Evidence-based addiction interventions, and (4) Diverse and vulnerable addiction populations. The certificate is responsive to the needs of counselors, family therapists, social workers, clinical nurses, psychologists or those in related fields (e.g., public health professionals) seeking continuing education credits, or counselors seeking additional elective academic credits to complete licensure requirements in the state of Maryland.

Faculty:

Clinical Assistant Professor
Risco, Cristina M.

Admissions Information

For complete admission information, please visit: http://oes.umd.edu/professional-programs/addiction-science-and-intervention/admission-information

UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS).For additional requirements, please visit: http://oes.umd.edu/professional-programs/addiction-science-and-intervention/admission-information#international

All application materials must be received by the deadlines below.

Domestic students:
Term I (Fall) by June 1
Term III (Spring) by December 1

International students:
Term I (Fall) by February 1
Term III (Spring) by October 1

Application Deadlines

Application Requirements

Degree Requirements

Addiction Science and Intervention (GCPS)

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/addiction-science-and-intervention

Courses:

Agricultural and Resource Economics (AREC)

Abstract

The Department offers both M.S. and Ph.D. degrees from one of the nation's premier graduate programs in agricultural and resource economics. Both programs focus on the application of advanced microeconomic theory and econometrics to issues in environmental and resource economics, agricultural economics, and development economics. Courses are taught by leading researchers in those fields, who combine rigorous scholarship with extensive policy experience.

The Department's faculty includes internationally prominent scholars in environmental and resource economics, agricultural economics, and development economics. In recognition of their research, Department faculty members have received such international awards as Germany's Alexander von Humboldt Prize, the American Economic Association's John Bates Clark Medal, and the Agricultural and Applied Economics Association's Quality of Research Discovery and Publication of Enduring Quality Awards, among others. Several have been elected fellows of such professional associations as the Agricultural and Applied Economics Association (formerly the American Agricultural Economics Association), the Association of Environmental and Resource Economics, the Econometric Society, and the American Statistical Association. Department faculty members have served as presidents of the American Agricultural Economics Association and Association of Environmental and Resource Economists and as editors and associate editors of the Journal of Environmental Economics and Management, the American Journal of Agricultural Economics, the Journal of Public Economics, and Environment and Development Economics, among others. One faculty member is currently a research fellow of the National Bureau of Economic Research. For additional Department highlights, please visit www.arec.umd.edu/graduate/prospective-students.

The policy experience of the Department's faculty is equal to its scholarship in both quality and extent. Three have served on the staff of the President's Council of Economic Advisers. Other policy experience includes service as consultants to agencies and organizations like the U.S. Department of Justice, the U.S. Department of Agriculture, the Environmental Protection Agency, the World Bank, and the Inter-American Development Bank. The University's location in the Washington, D.C., area provides numerous opportunities for interaction with the World Bank, International Food Policy Research Institute, Resources for the Future, International Monetary Fund, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Agency for International Development, Food and Drug Administration, Inter-American Development Bank, Census Bureau, and a host of other such institutions and organizations.

Questions about the Department's graduate programs should be directed to the Graduate Program Coordinator at arecgradpgm@umd.edu or 301-405-1820.

Admissions Information

Faculty:

Chair
Chambers, Robert G.

Distinguished University Professor
Just, Richard E.
Nerlove, Marc L.

Professor
Alberini, Anna
Chambers, Robert G.
Hanson, James C.
Lichtenberg, Erik
Lopez, Ramon E.
Lynch, Loretta M.
McConnell, Kenneth E.
Olson, Lars J.
Williams, Roberton III

Associate Professor
Leathers, Howard D.
Leonard, Kenneth

Assistant Professor
Barrage, Lint
Gunnsteinsson, Snaebjorn
Holzer, Jorge Bilbao
Houde, Sebastien
Jakiela, Pamela
Newburn, David
Zaki, Mary

Adjunct Professor
Chavas, Jean Paul
Hoddinott, John
Lange, Andreas
List, John A.
McNew, Kevin P.
Quiggin, John C.

Affiliate Professor
Cramton, Peter
Cropper, Maureen L.

University Affiliate
Stephen W. Salant

Professor Emerita
Bockstael, Nancy E.

Professor Emeritus
Brown, Earl H.

At a minimum, students entering either the Department's M.S. or Ph.D. program are expected to have the following preparation:

- Knowledge of macroeconomic theory at the intermediate level and microeconomic theory at the advanced level.
- Knowledge of multivariate calculus and linear algebra.
- Knowledge of elementary statistical methods.

Additional coursework in mathematics is desirable--for example, analysis, probability, advanced statistics, or differential equations.

Students are normally admitted to the MS and PhD programs only for the fall semester, because the first year program consists of course sequences that begin only in the fall.

Transfer from M.S. to Ph.D. Program

Students enrolled in the Department's M.S. program may apply for admission to the Department's Ph.D. program by submitting a new Graduate School application, supplemental transcripts, and three letters of recommendation. The Graduate School application fee is waived if the student applies for the Ph.D. program in or before the semester in which the M.S. degree will be completed. Students within the Department's M.S. program need not submit GRE's when applying for the Ph.D. program.

Application Deadlines

Fall:
Applications must be received by January 15 (**January 15 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

University of Maryland's Graduate Application Process The University of Maryland's Graduate School accepts applications through its ApplyYourself/Hobsons (link is external) application system. Before completing the application, applicants are asked to check the Admissions Requirements (link is external) site for specific instructions.

As required by the Graduate School, all application materials are to be submitted electronically:

1. Graduate application Graduate application (link is external)
2. Graduate Record Examination (GRE) scores
3. Transcripts
4. Statement of purpose
5. Three letters of recommendation
6. A curriculum vitae or resume
7. A listing of all economics, mathematics and statistics courses taken
8. Non-refundable application fee ($75) for each program to which an applicant applies
9. Students from non-English-speaking countries are required to demonstrate English proficiency by providing scores from the Test of English as a Foreign Language (TOEFL).

The electronic submission of application materials helps expedite the review of an application. Completed applications are reviewed by an admissions committee in each graduate degree program. The recommendations of the committees are submitted to the Dean of the Graduate School, who will make the final admission decision. Students seeking to complete graduate work at the University of Maryland for degree purposes must be formally admitted to the Graduate School by the Dean. To ensure the integrity of

Cain, Jarvis L.
Hardie, Ian W.
Hueth, Darrell L.
Moore, John H.
Strand, Ivar E., Jr.
Tuthill, Dean Fanning

Associate Professor Emeritus
Lipton, Douglas W.

the application process, the University of Maryland authenticates submitted materials through TurnItIn for Admissions (link is external).

Information for International Graduate Students

The University of Maryland is dedicated to maintaining a vibrant international graduate student community. The office of International Students and Scholars Services (link is external) (ISSS) is a valuable resource of information and assistance for prospective and current international students. International applicants are encouraged to explore the services they offer, and contact them with related questions. The University of Maryland Graduate School offers admission to international students based on academic information; it is not a guarantee of attendance. Admitted international students will then receive instructions about obtaining the appropriate visa to study at the University of Maryland which will require submission of additional documents. Please see the Graduate Admissions Process for International applicants (link is external) for more information.

Degree Requirements

Doctor of Philosophy (Ph.D.)

The Ph.D. program trains students to design, perform, lead, and implement economic research projects in the fields of environmental and resource economics, agricultural economics, and development economics. It also trains students in how to disseminate research results in the major professional media including journals, reports, conferences, and seminars. It provides rigorous training in microeconomic theory and econometrics and in the application of microeconomics and econometrics to policy issues. Students completing their Ph.D. degrees find employment in academia, U.S. government agencies, international organizations, and consulting firms.

Requirements for the Ph.D. degree include a minimum of 42 credits of coursework, completion of a four course field, 12 credits of Ph.D. dissertation research (AREC 899), development of a research paper worthy of submission to a well-regarded journal, development and defense of a dissertation prospectus, and successful defense of a Ph.D. dissertation.

The first year of the program consists of basic coursework in microeconomic theory, econometrics, and mathematical methods. It consists of the following courses: A two-semester sequence in microeconomic theory (ECON 603 and 604); A two-semester sequence in applied econometrics (AREC 623 and 624); A one-semester course on mathematical optimization (AREC 620); A one-semester course on applications of microeconomic theory to agricultural and resource economics (AREC 610).

Students must earn a "B-" or better in each of these courses and a B (3.0) average or better in graduate coursework. If necessary, students can re-take these courses one time to achieve this standard. The first-year course requirements account for 20 credits (3 credits each for ECON 603, ECON 604, AREC 620, and AREC 610, plus 4 credits each for AREC 623 and AREC 624). First-year students are also expected to complete self-directed instruction regarding econometric software during August and January, attend additional instruction and develop qualifying paper topics during January, and participate in a paper-writing workshop in June at the end of the first year. The June workshop helps students develop their research for publication in academic journals as well as oral presentation. This workshop is useful for fostering the completion of the required research paper.

The second year of the program consists mainly of six elective courses. All students are required to take four courses from among the following courses offered in AREC: AREC 783, AREC 785, AREC 815, AREC 825, AREC 832, AREC 845, AREC 846, and ECON 781 with the remainder from that list, from graduate courses offered by the Economics

Department or (with approval by the Director of Graduate Studies) from another supporting department on campus.

Master of Science (M.S.)
The M.S. program trains students to conduct economic research in the fields of environmental and resource economics, agricultural economics, and development economics. It provides rigorous training in microeconomic theory and econometrics and in the application of microeconomics and econometrics to policy issues. Students completing their MS degrees go on to work in U.S. government agencies and international organizations.

The M.S. program requires a minimum of 33 credits of coursework (i.e., 16 credits of electives in addition to the 17 credits of required coursework) and defense of a scholarly paper. No M.S. thesis is required.

Required courses for the M.S. program consist of basic coursework in microeconomic theory and econometrics:

- The first semester of the sequence in microeconomic theory (ECON 603).
- A two-semester sequence in applied econometrics (AREC 623 and 624).
- A one-semester course on mathematical optimization (AREC 620).
- A one-semester course on applications of microeconomic theory to agricultural and resource economics (AREC 610).

The first-year coursework normally includes these 17 credits (3 credits each for ECON 603, AREC 620, AREC 610 plus 4 credits each for AREC 623 and AREC 624).

M.S. students fulfill additional coursework requirements by taking electives to suit their own interests during their second year. Elective courses are normally selected from M.S. level courses (600 level or above) in AREC or ECON but may be taken in other disciplines with adviser approval. For detailed information on the scholarly paper, see the "MS Scholarly Paper Requirement" at http://www.arec.umd.edu/graduate/ms/ms-scholarly-paper-requirement.

Facilities and Special Resources

The AREC Department provides a 15-seat computer lab for the exclusive use of our graduate students. The lab is available 24 hours a day, 365 days a year. Another 25-seat lab is available by reservation for classes, presentations, and research (e.g., experimental economics sessions). These labs are equipped with thin client devices that connect end users to desktop virtual desktops. This solution allows graduate students to remotely access a virtual desktop with all the applications listed below, as well as their files stored on the network servers. The following applications are available at this time: ArcInfo, Fortran, Mathematica, Matlab, Mozilla Firefox, MS Office, R, SAS, Stata, StatTransfer,TextPad, Lyx and WinEdt. Graduate students can access the AREC network and Internet from home via several remote access methods. A multifunction printer/scanner/copier is available in the graduate student computer lab. Wireless access is available to the campus network.

The Department offers close proximity to an incomparable array of government agencies, international institutions, and non-governmental organizations devoted to environmental issues, agricultural policy, natural resource management, and international development. Opportunities for attending stimulating seminars abound. Many students find useful work experience, access to data, and cutting-edge thesis topics as well as future employment through these organizations. These include (all within approximately 10 miles) the U.S.

Environmental Protection Agency, the U.S. Department of Agriculture and U.S. Economic Research Service, the U.S. Food and Drug Administration, Resources for the Future, the Joint Institute for Food Science and Nutrition, the Joint Global Change Research Institute, the National Center for Smart Growth Research and Education, the National Oceanic and Atmospheric Administration, the World Bank, the Inter-American Development Bank, the International Food Policy Research Institute, the Beltsville Agricultural Research Center with its National Agricultural Library, as well as the U.S. Capitol, Senate, and House of Representatives.

Financial Assistance

Graduate assistantships are offered to qualified applicants on the basis of past academic performance, research potential, and availability of funds. Many full-time students in the Department hold assistantships or some other form of financial aid. Part- time and summer work are sometimes available for students who do not have assistantships. Graduate fellowships are also available on a competitive basis. The Department offers financial assistance in the form of graduate assistantships and fellowships. To apply, use the form for requesting financial assistance included in the Graduate School application packet.

Graduate Assistantships

Many of our students are supported by graduate assistantships with responsibilities for either research or teaching. Graduate assistants are expected to work an average of 20 hours a week on their research or teaching duties. They must maintain at least a B average. They are considered employees of the University and are thus covered by health insurance. In addition to a competitive salary, graduate assistants receive tuition remission for up to 10 credits in the fall and spring semesters and up to 4 credits each summer semester.

Fellowships

The Department awards a number of fellowships each year to highly qualified applicants. Annual fellowship stipends are highly competitive. Fellowship awards also include tuition remission of up to twelve credits per semester. Fellowships are awarded to Ph.D. students for two (2) years. After the expiration of the fellowship, the Department expects to provide Ph.D. fellowship recipients with an additional two years of support as a graduate assistant subject to satisfactory academic progress.

All applicants for financial aid are automatically considered for fellowships as well as assistantships.

Financial assistance in the form of loans and work study may also be available. Interested students should contact the University's Office of Student Financial Aid.

Contact Information

The AREC Graduate Program website at http://www.arec.umd.edu/graduate provides course requirements, examination procedures, and descriptive material for the M.S. and Ph.D. programs.

Graduate Program
Agricultural and Resource Economics, 2200 Symons Hall, University of Maryland

College Park, MD 20742
Telephone: (301) 405-1820
arecgradpgm@umd.edu

http://www.arec.umd.edu/

Courses: AREC

American Studies (AMST)

Abstract

American Studies offers an interdisciplinary program of study leading to the Masters of Arts and the Doctor of Philosophy degrees. Research and teaching in the Department focus on two intellectual themes: the cultures of everyday life, and cultural constructions of identity and difference. These themes drive our examinations of multiple cultures within the U.S., across the Americas, and transnationally. They also embrace numerous cultural studies approaches, including material and visual culture, ethnography and life history, popular culture and media studies, queer studies, studies of the body and sexualities, gender studies, food studies, digital cultures, critical race studies, and cultural landscapes and geography. Students develop expertise in multiple methodologies and take courses in many departments across the University... The Department benefits from a large and diverse affiliate faculty, strong relationships with cultural institutions such as the Smithsonian museums, and ready access to many other museums in the Baltimore-Washington corridor, government agencies, archives and historical societies, and multiple local communities. Students may also take advantage of graduate certificate programs for which our courses apply, including Museum Scholarship and Material Culture, Critical Theory, Historic Preservation, and Women's Studies. The program in U.S. Latina/o Studies is contained within the Department, and we have a leadership role in developing Native American Studies.

Admissions Information

Many admitted students have previously majored in American Studies, History, English, Ethnic Studies, Women's Studies, Anthropology, Art or Architectural History, Journalism, and Communications. However, applicants with broad backgrounds in arts and humanities and/or the behavioral and social sciences are also given serious consideration if interdisciplinary, American Studies-related subject matter or theories have been emphasized. Application requirements for both M.A. and Ph.D. programs include: 1) Graduate School application, 2) statement of purpose (including research interests), 3) three letters of recommendation, 4) official academic transcripts for all undergraduate and graduate work, 5) GRE scores, 6) a writing sample, and 7) a resume or curriculum vitae. International applicants must also submit TOEFL scores. Applicants who do not yet have M.A. degrees and who desire to obtain the Ph. D. degree at Maryland should apply directly to the Ph.D. program.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Graduate School application
2. Statement of purpose, including research interests
3. 3 letters of recommendation
4. Official transcripts of all undergraduate and graduate work
5. GRE scores
6. Writing sample
7. Resume or Curriculum Vitae.

Faculty:

Chair
Williams-Forson, Psyche

Professor
Kelly, R. Gordon
Paoletti, Jo B.
Struna, Nancy L.
Wong, Janelle

Associate Professor
Farman, Jason
Hanhardt, Christina Benes
Lounsbury, Myron O.
Parks, Sheri L.
Sies, Mary C.
Williams-Forson, Psyche

Assistant Professor
Bruce, La Marr Jurelle
Guerrero, Perla
Padios, Jan

Affiliate Professor
Berlin, Ira
Bolles, A. Lynn
Brower, Sidney
Caramello, Charles A.
Chambers, Erve
Dill, Bonnie T.
Donawerth, Jane L.
Falk, William W.
Finkelstein, Barbara J.
Gilbert, James B.
Hallett, Judith P.
Harrison, Regina
Howland, Marie
Hurtt, Steven W.
Kim, Seung-Kyung
King, Katherine R.
Leonardi, Susan
Leone, Mark P.
Levine, Robert S.
Pearson, Barry L.
Peterson, Carla L.
Ray, Sangeeta
Ritzer, George
Robertson, Carol E.
Rosenfelt, Deborah S.
Shneiderman, Ben A.
Smith, Martha Nell
Washington, Mary Helen

Affiliate Associate Professor
Barkley Brown, Elsa
Freidenberg, Judith N.
Gournay, Isabelle J.
Graber, Mark A.
Grimsted, David A.
Harley, Sharon
Kelly, Franklin W.
Kirschenbaum, Matthew G.
Klumpp, James F.
Landry, L. Bartholomew
Lindemann, Marilee

Degree Requirements

Master of Arts (M.A.)
Students take a total of 30 credits of course work in American Studies and related disciplines and demonstrate the ability to conduct independent research by submitting an acceptable thesis or a scholarly paper in lieu of a thesis.

Doctor of Philosophy (Ph.D.)
Ph. D. students complete at least 30 credit hours that are organized around two areas of specialization or more. Students must also pass two comprehensive examinations (one general, the other specialized) and, after submitting a detailed prospectus, write and defend an interdisciplinary dissertation that answers significant questions about American culture(s) and experiences, past or present.

Facilities and Special Resources

The Washington, D.C. and Baltimore areas offer extraordinary research facilities for the study of past and present Americans' experiences and culture, including the Library of Congress, the National Archives, the Smithsonian's many institutions, the National Park Service, the Maryland Historical Society, and the Walters Art Museum and National Gallery, and other cultural institutions. The National Archives II, National Trust Library and Library of American Broadcasting are all located on the College Park campus. There are also numerous local and regional-focused museums, collections, archives, libraries, and "think tanks" that can support students' interests in issues and topics related to identity and difference and the cultures of everyday lfe. Through consortia arrangements with universities in the area, including George Washington University and Georgetown University, students may augment their programs with courses otherwise unavailable at the University of Maryland.

Financial Assistance

A limited number of teaching assistantships are available in addition to graduate fellowships. Students who hold assistantships typically teach two sections of AMST 201, Introduction to American Studies, or AMST 205, Material Aspects of American Life.

Contact Information

Additional information on program offerings, degree requirements and financial aid can be obtained on the department's Web site (http://www.amst.umd.edu) and by writing to:

Director of Graduate Studies, Christina B. Hanhardt
4115 Susquehanna Hall Department of American Studies
College Park
MD 20742-5620
Telephone: (301) 405-1354
Fax: (301) 314-9453
hanhardt@umd.edu

http://www.amst.umd.edu

Courses: AMST

Related Programs and Campus Units

Historic Preservation and Real Estate Development

Moss, Alfred A., Jr.
Muncy, Robyn L.
Nunes, Zita
Paterson, Judith
Rowland, Leslie S.
Shackel, Paul A.
Sicilia, David B.
Simpson, Sally S.
Steve M. Barkin
Sullivan, John B. (Jack)
Wang, Orrin

Professor Emeritus
Caughey, John L.

Animal Sciences (ANSC)

Note: Some courses in this program may require the use of animals. Please see the Statement on Animal Care and Use and the Policy Statement for Students.

Abstract

The Graduate Program in the Animal Sciences offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. The master's degree program does not offer the non-thesis option. Faculty research interests include: 1) Cell, molecular and developmental biology studies, gene expression of the neuroendocrine system during growth and development, molecular genetics of metal and heme homeostasis in animals, maintenance of pluripotency and cell lineage determination in early embryos and embryonic stem cells, regulation of gene expression during embryonic patterning, neuro- and reproductive endocrinology in avian and fish species, and virology, immunology and microbial pathogenesis of significance to animal agriculture; 2) Nutrition and intermediary metabolism of ruminants and non-ruminants, regulation of milk fat production in dairy cattle, modeling for nutrient management, nutrient management in avian and other monogastric species, including forage utilization in horses; nutritional immunology, nutrient sensing, metabolic homeostasis, companion and exotic animal nutrition; 3) Aquaculture related fish physiology, cryopreservation of germ cells, neuroendocrine control of reproduction and reproductive dysfunction induced by stress, or endocrine disrupting chemicals, and; 4) Application of computational and systems biology to quantitative genetics, genomics, epigenetics, selection theory and breeding for the improvement of domestic animals and conservation genetics.

Admissions Information

The Program requires applicants to submit an application online, and to submit official academic transcripts, statement of goals and research interests, at least three letters of recommendation, and official Graduate Record Examination scores to the Enrollment Services Operations Office. Applicants with degrees from non-English speaking countries and who have not received a degree from the list of approved English-speaking universities must also submit results of the Test of English as a Foreign Language (TOEFL). To be considered for an assistantship, submit your application by the preferred deadline.

Application Deadlines

Fall:
Applications must be received by March 15 (**February 1 preferred**) .
Spring:
.
Applications must be received by October 1 (June 1 preferred) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE (Verbal; Quantitative; Analytical/Writing)
2. TOEFL (if required)
3. 3 Letters of Recommendation
4. An application
5. Official academic transcripts
6. Statement of goals and research interests

Degree Requirements

Master of Science (M.S.)
During the first semester, the student selects an Adviser and an Advisory Committee (AC) with the approval of the Program Graduate Education Committee. By the end of the

Faculty:

Chair
Stahl, Chad

Director
Keefer, Carol L.

Professor
Angel, C. Roselina
Erdman, Richard E.
Hamza, Iqbal
Keefer, Carol L.
Kohn, Richard A.
Ottinger, Mary A.
Peters, Robert R.
Porter, Tom E.
Stahl, Chad

Associate Professor
Burk, Amy O.
Song, Jiuzhou
Stricklin, William R.
Taneyhill, Lisa
Woods, L. Curry, III
Xiao, Zhengguo
Yu, Liqing
Zimmermann, Nickolas G.

Assistant Professor
Biswas, Debabrata
Dennis, Rachel
Kim, Byung-Eun
Ma, Li
Moyes, Kasey
Orlando, Edward F.
Telugu, Bhanu P.

Adjunct Professor
Pukazhenthi, Budhan

Adjunct Associate Professor
Baldwin, Ransom
Comizzoli, Pierre
Liu, Ge
Songsasen, Nucharin

Adjunct Assistant Professor
Connor, Erin E.

Affiliate Professor
Samal, Siba K.

Affiliate Associate Professor
Perez, Daniel

Professor Emeritus
Mather, Ian H.
Varner, Mark A.

second semester, with the AC's advice, students file a proposed schedule of courses (plan of study). Committees may require that students take remedial courses if they enter with inadequate prerequisites or deficiencies in undergraduate programs. Also, by the end of the second semester a thesis research proposal must be approved by the student's AC. Course requirements comprise at least one semester of Biochemistry (3 credits; typically BCHM 463), one semester of Biometrics (4 credits; typically BIOM 601), one credit of seminar (ANSC 698) and a course in Research Ethics. Additional credits of graduate coursework should result in a total of 24 credits, of which no more than 12 credits can be at the 400 level. Furthermore, a minimum of six hours of thesis research credit (ANSC 799) is required. Towards the end of their graduate studies, students must present the results and conclusions of their research in a public seminar and successfully defend their written thesis in a final oral examination, which is given by the AC. A final copy of the thesis must be submitted to the Program Office. Students with adequate undergraduate training usually complete the master's degree within two years.

Doctor of Philosophy (Ph.D.)
Ph.D. students with Master's degrees from other institutions are expected to meet the requirements indicated above for the ANSC M.S. degree. The M.S. degree is not a prerequisite but is advantageous for admission to the Ph.D. program. At least two credits of Seminar (with at least one in ANSC 698) and one semester of teaching experience (8-10 hours per week) are required during study for the Ph.D. degree. In addition, a minimum of 12 research credits is required. A plan of study and a research proposal must be filed with the approval of the student's Adviser and Advisory Committee (AC) by the end of the third semester. After no more than five semesters, the student must pass the Admission to Candidacy Examination, which consists of both written and oral components and is administered by the AC. Towards the end of their studies, the candidates present the results and conclusions of their graduate research in a public seminar and defend their research in an oral examination, which is adjudicated by the student's AC. In addition to successful defense of the dissertation, it is expected that the student will publish at least one paper in a refereed scientific journal, based on the dissertation research. A final bound copy of the dissertation must be submitted to the Program Office. The Ph.D. degree is usually completed within four years after the M.S. degree.

Facilities and Special Resources

The Department of Animal and Avian Sciences and the nearby Gudelsky Veterinary Center housing the Virginia-Maryland Regional College of Veterinary Medicine, have extensive facilities consisting of faculty research laboratories, animal holding areas, a campus farm, aquaculture facility and outlying research farms. Additionally, the department maintains two computer laboratories with 30 workstations in the teaching laboratory, and a smaller laboratory exclusively for the use of graduate students on a 24 hour basis.

The research laboratories comprise nearly 28,000 square feet for bench work, averaging over 1000 square feet per faculty member. Over 2800 square feet of cold room and 2000 square feet of freezer rooms are integral components of the research laboratories. The laboratories are fully equipped with state-of-the-art modern instrumentation and equipment for the entire range of research carried out by the faculty, e.g. research in biochemistry, cell-molecular biology, physiology, nutrition, behavior, virology, immunology, microbial pathogenesis etc. Individual laboratories are fully self-standing units, yet there is free exchange between laboratories having shared and collaborative interests. All the laboratories and offices are networked to the campus server for direct Internet access.

Nearly 15,000 square feet of space is dedicated for animal holding in the Animal Wing of the Animal Sciences Center. This facility is capable of handling all kinds of animals such as rodents, birds, fish and large animals for research in separate rooms. A new aquaculture facility, adjoining the Gudelsky Center, is also available. The Animal Wing is under the care of trained staff and is supervised by a professional veterinarian.

Other facilities, such as the Laboratory for Biological Ultrastructure, the Visual Imaging Center, the DNA Sequencing Laboratory,the Proteomics Core Facility, etc., are available to the faculty and students as part of the Central Core Facilities on the campus.

Off Campus Research Facilities include:-

1. University of Maryland/USDA-Beltsville Animal Biotechnology Facility

An 11,000 square foot cooperative facility for research in animal biotechnology at the Beltsville Agricultural Research Center. This Center includes laboratories specifically designed for research in cloning and transgenic biology. ANSC faculty engaged in nuclear cloning, stem cell and transgenic biotechnology may use this facility to investigate genes of significance for the growth, development and physiology of domestic animals.

2. Central Maryland Research and Education Center, Clarksville, MD

This 925-acre dairy research center, located ~25 miles from the campus, houses 200 head of Holstein dairy cattle including 110 milking cows and 90 head of young stock. ANSC faculty engaged in nutrition, reproduction, physiology, herd health, behavior and management research, conduct their experiments at this facility.

3. Applied Poultry Research Laboratory, Upper Marlboro, MD

This 202-acre facility is located approximately 20 miles from the campus. It is used for conducting research in nutrition, physiology and behavior.

4. Wye Beef Cattle Research Center

This 450-acre facility is located on Maryland's Eastern Shore near Queenstown. It has 250 registered Angus beef cows plus young stock and bulls which are direct descendants of the Wye Angus herd. The facility is used to support research associated with beef cow-calf management, pasture management and growth physiology.

Financial Assistance

A number of graduate combined research/teaching assistantships are available and awarded to students who present strong academic records and a capability and motivation to perform well in teaching or in research assignments. These assistantships are awarded on a competitive basis. Appointments are on an annual basis, with reappointment contingent on demonstration of successful progress towards the degree. Assistantships are available for up to two years for the M.S. degree and four years for the Ph.D. degree. As assistantships are generally awarded for Fall admittance, applications should be completed by the February 1 deadline for consideration.

Contact Information

For specific information on the program, admission procedures, or financial aid, see the ANSC website (http://ansc.umd.edu/graduate) or contact the ANSC graduate program office as listed below.

Victoria Lake, ANSC Graduate Office
Room 1415A Animal Sciences Center, Department of Animal and Avian Sciences, Univ. of Maryland College Park
MD 20740
Telephone: 301-405-5781
ansc-gradprogram@umd.edu

http://ansc.umd.edu/Graduate/

Dr. Carol L. Keefer, Professor and Director
Graduate Program in Animal Sciences
Room 2129 Animal Sciences Center
Department of Animal and Avian Sciences
Univ. of Maryland
College Park
MD 20742-2311
Telephone: 1-301-405-5781
ansc-gradprogram@umd.edu

http://ansc.umd.edu/Graduate

Courses:

Related Programs and Campus Units

Veterinary Medical Sciences
Neuroscience and Cognitive Science
Applied Mathematics & Statistics, and Scientific Computation
Nutrition and Food Science

Anthropology (ANTH)

Abstract

The Department of Anthropology offers graduate study leading to the Master of Applied Anthropology (MAA) and the Doctor of Philosophy (PhD) degrees. Both degrees reflect the department's special interest and expertise in the applications of anthropology. Current faculty members represent the subfields of the discipline (archaeology and socio-cultural anthropology). Drawing their intellectual and applied orientations from training and application of the above subdisciplines, the department's faculty also recognize the need to identify topics or problems where the expertise of individual faculty members can be applied in a manner that integrates the subdisciplines. In this ongoing effort, the faculty has identified three areas of research concentration: Anthropology of Health, Anthropology of Environment, and Anthropology of Heritage. The areas can be thought to contain and generate research problems of interest to the faculty's experience and expertise within the subdisciplines. These problems can be addressed individually through socio-cultural anthropology and archaeology. However, the anthropological contribution to addressing these problems is enhanced by collaboration across subdiscipline interests and expertise. The Master of Applied Anthropology (MAA) is a program designed both for students interested in an anthropology career outside of academia and for those who plan on continuing to a PhD. The program has been offered at the University of Maryland since 1984, and graduates have successfully secured employment or pursued doctoral work in a variety of fields, such as working in the areas of medical and health practice, urban and regional planning and development, community development, conservation and heritage resource development, cultural resource management, and historical archaeology. The focus of the MAA program has been to participate in the building of anthropological practice. A major focus of the Doctor of Philosophy (PhD) program is to direct research scholarship and to encourage theoretical and methodological advancement in such a way as to reflect upon the specific practices of anthropology, with the aim of improving those practices and thereby increasing the value and usefulness of the discipline. Doctoral students are typically prepared for research and development careers outside of academic settings, as well as for academic careers in anthropology departments and other disciplinary settings.

Faculty:

Chair
Shackel, Paul A.

Professor
Chernela, Janet
Freidenberg, Judith N.
Leone, Mark P.
Paolisso, Michael J.
Shackel, Paul A.

Associate Professor
Brighton, Stephen

Assistant Professor
Downey, Sean
Getrich, Christina
Hambrecht, George
Lafrenz Samuels, Kathryn
Sangaramoorthy, Thurka
Sangaramoorthy, Thurka
Shaffer, Laura Jean
Stuart, William T.

Postdoctoral Research Associate
Haas, Randy

Postdoctoral Fellow
Bocast, Brooke

Professor Emeritus
Whitehead, Tony L.

Admissions Information

Students are required to submit Graduate Record Examination (GRE) scores and fulfill the Graduate School admission requirements. **Application deadline for all applicants, domestic and international, is January 1st.**

Application Deadlines

Fall:
All international and domestic applications must be received by December 15 .
Spring:
This program does not accept applications for this semester.
Summer:
This program does not accept applications for this semester.

Application Requirements

1. **Graduate School requirements**
2. **GRE General**
3. **Statement of Intent and Experience**
4. **Three (3) Letters of Recommendation**
5. **Writing sample**
6. **Resume**

Degree Requirements

Master of Applied Anthropology (M.A.A.)
The program requires 42 credit hours of coursework, including a core sequence (18 credit hours), an internship sequence (12 semester hours), and a sequence of individually approved courses that are related to a chosen domain of application (12 semester hours). MAA students must satisfactorily complete an internship proposal review with their advisory committee before beginning the internship, which is normally completed during the summer term between the first and second years of the program. Students are also required to present the results of their internship in a departmental colloquium prior to graduation. There is no thesis requirement.

Doctor of Philosophy (Ph.D)
Students entering the PhD from a bachelor's degree must normally complete all the requirements for the MAA degree indicated above, although the internship sequence can be substituted with additional coursework under approved circumstances. An additional minimum of 30 credit hours of advanced coursework is required, to include at least 12 credit hours of dissertation research. For students entering the PhD program from the MAA, an additional minimum of 30 credit hours of advanced coursework is required, to include at least 12 credit hours of dissertation research. Students entering the PhD program with a master's degree from another institution are minimally required to complete the 18 credit-hour core sequence of the MAA program and an additional minimum of 30 credit hours of advanced coursework, to include at least 12 credit hours of dissertation research. These students are not normally required to complete the internship sequence, although in some cases their doctoral committee may decide that an internship may be appropriate to enhance a student's professional experience prior to graduation. Additional supportive coursework may be required on a case-by-case basis depending on the qualifications of the student. In such cases, these expectations will be specified upon admission to the PhD program. Substitutions for courses in the MAA core sequence are rarely permitted and must be approved by the Graduate Committee and the Department Chair. Students admitted to the PhD program advance to candidacy upon completion of a written comprehensive examination and an oral defense of their dissertation proposal. An oral defense upon completion of the dissertation is also required.

Facilities and Special Resources

The Department of Anthropology has four archaeology labs: the Archaeological Heritage Lab, a lab related to the Archaeology in Annapolis project, a lab related to Irish Rural Lifeways, and a zooarchaeology lab. Additional research facilities include the Center for Heritage Resource Studies (CHRS), which conducts and supports basic and applied research in heritage resource studies, one Ecological Anthropology lab, a Human Complexity and Modelling lab, and the Immigrant Life Course Research Program.

Financial Assistance

A limited number of Departmental Fellowships and Teaching Assistantships are available to qualified graduate students. Part-time employment related to department research is occasionally available.

Contact Information

For additional information please contact:

Dr. Michael Paolisso, Graduate Director
0131 Woods Hall
College Park
MD 20742
Telephone: 301-405-1433
Fax: 301-314-8305
mpaoliss@umd.edu

http://www.anth.umd.edu

Nadine Dangerfield, Graduate Program Coordinator
1111 Woods Hall College Park, MD 20742
MD 20742
Telephone: 301-405-4737
nadineyd@umd.edu

http://www.anth.umd.edu

Courses: ANTH

Related Programs and Campus Units

Historic Preservation
Women's Studies

Applied Economics (MPEM)

Abstract

Admissions Information

The Masters of Professional Studies in Applied Economics program (MPEM) offers only fall admission. The application deadline for all enrollment is January 15 for international students and June 15 for domestic students. The MPEM professional masters program is a full-time program and its students are eligible for F1 or J1 student visas.

Faculty:

University Affiliate
Belenskiy, Maksim E.
Bresnahan, Lauren
Epstein, Brendan
Erdem, Erkan
Feldman, Naomi
Grittiths III, Charles
Kawano, Laura
Kilic, Rehim
Leibtag, Ephraim
Neri, John
Richard, Patrick

Application Deadlines

Application Requirements

Sacher, Seth
Stocking, Andrew
Straub, John D.
Vazquez-Grande, Francisco
Wilson, Nathan E.

Applicants must have earned a grade of B or better in Principles of Microeconomics and Principles of Macroeconomics. Applicants must have one semester of Calculus with a grade of B- or better and an overall grade point average of 3.0 in order to be admitted. International students from non-English speaking countries or who have not earned a degree from a U.S. or English-speaking country must submit TOEFL, IELTS, or PTE scores.

Degree Requirements

Graduate Certificate in Ecnonomic Analysis (Certificate)
The Graduate Certificate in Economic Analysis is awarded to students who have successfully completed the five core courses of the Masters in Applied Economics curriculum.

Master of Professional Studies in Applied Economics (M.P.S.)
The Master of Professional Studies in Applied Economics is a full-time professional masters program emphasizing quantitative analysis of applied econometrics. The curriculum includes all aspects of econometric modeling (including data collection, management and analysis) and incorporates hands-on STATA exercise into instruction. Courses provide students with rigorous training in economic reasoning, and formulating and estimating empirical economic models, with particular emphasis on using quantitative methods to evaluate policy proposals and programs. The 10-course program includes 5 "core courses" in econometrics (a 3-course sequence), microeconomics and macroeconomics. Field courses (including Economics of Health Care, Law and Economics, Environmental Economics, Program Evaluation and Game Theory/Market Design) allow students to apply the tools learned in the core courses to specific topics related to economics and public policy.

Facilities and Special Resources

Classes are held in the evenings on the main campus of the University of Maryland in College Park.

Financial Assistance

Contact Information

John Straub, Executive Director of Professional Master's Program
3127C Tydings Hall
University of Maryland
MD 20740
Telephone: (301) 405-3531
masters@econ.umd.edu

http://masters.econ.umd.edu

Eileen Kramer, Coordinator of Graduate Studies
3127E Tydings Hall
University of Maryland
MD 20740
masters@econ.umd.edu

Courses: ECON

Applied Economics (MPEC)

Abstract

Admissions Information

The Masters of Professional Studies in Applied Economics program offers fall and spring admission. The application deadline for fall enrollment is June 15 and the application deadline for spring enrollment is December 15. The professional masters program is a part-time program and cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas). Citizens of foreign countries who currently reside in the U.S. on visas which permit them to undertake part-time study are welcome to apply provided that they submit a copy of the valid visa and I-94 card.

Application Deadlines

Application Requirements

Applicants must have earned a grade of B or better in Principles of Microeconomics and Principles of Macroeconomics. Applicants must have one semester of Calculus with a grade of B- or better and an overall grade point average of 3.0 in order to be admitted.

Degree Requirements

Master of Professional Studies in Applied Economics (MPEC)
The Master of Professional Studies in Applied Economics is a part-time professional masters program emphasizing quantitative analysis applied econometrics. The curriculum includes all aspects of econometric modeling (including data collection, management and analysis) and incorporates hands-on STATA exercises into instruction. Courses provide students with rigorous training in economic reasoning, and formulating and estimating empirical economic models, with particular emphasis on using quantitative methods to evaluate policy proposals and programs. The 10-course program includes 5 "core courses" in econometrics (a 3-course sequence), microeconomics and macroeconomics. Field courses (including Economics of Health Care, Law and Economics, Environmental Economics, Program Evaluation and Game Theory/Market Design) allow students to apply the tools learned in the core courses to specific topics related to economics and public policy.

Graduate Certificate of Professional Studies in Economic Analysis (Z074)
The Graduate Certificate in Economic Analysis is awarded to students who have successfully completed the five core courses of the Masters in Applied Economics curriculum.

Facilities and Special Resources

Classes are held in the evenings in our DC classroom space, 1400 16th Street NW, Suite 140.

Financial Assistance

Contact Information

John Straub, Executive Director of Professional Master's Program
3127C Tydings Hall
University of Maryland College Park
MD 20740
Telephone: (301) 405-3531

Faculty:

University Affiliate
Belenskiy, Maksim E.
Bresnahan, Lauren
Epstein, Brendan
Erdem, Erkan
Feldman, Naomi
Griffiths III, Charles
Kawano, Laura
Kilic, Rehim
Leibtag, Ephraim
Neri, John
Richard, Patrick
Sacher, Seth
Stocking, Andrew
Straub, John D.
Vazquez-Grande, Francisco
Wilson, Nathan E.

masters@econ.umd.edu

http://masters.econ.umd.edu

Eileen Kramer/Coordinator of Graduate Studies
MD 20740
masters@econ.umd.edu

Courses: ECON

Applied Entomology (MPAE)

Faculty:

Abstract

The Master of Professional Studies in Applied Entomology, a 30-credit, 10-course graduate program may be completed in as little as 15 months. Offered through the convenience and flexibility of the online learning environment, students enroll in two 3-credit courses per 12-week term.

In addition to the MPS in Applied Entomology, the Department of Entomology developed several fully online graduate certificate programs. Designed to offer flexibility to complete coursework in areas specific to your needs and interests (as well as to gain a valuable credential), successful completion of one or more of these programs may be used to fulfill requirements for the MPS. Each 12-credit program may be completed in one year by taking one 3-credit course per 12-week term.The Graduate Certificate programs are as follows:
Graduate Certificate in Professional Studies in Beekeeping
Graduate Certificate in Professional Studies in Integrated Pest Management (IPM)
Graduate Certificate in Professional Studies in Organic and Sustainable Agriculture
Graduate Certificate in Professional Studies in Urban Agriculture

Admissions Information

For complete Admission Information, please visit: http://oes.umd.edu/professional-programs/entomology/entm-admission-information

UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS).Additional requirements can be found here: http://oes.umd.edu/professional-programs/entomology/entm-admission-information#international

Application Deadlines

Application Requirements

Degree Requirements

Master of Professional Studies in Applied Entomology (MPAE)
The Master of Professional Studies in Applied Entomology, a 30-credit, 10-course graduate program may be completed in as little as 15 months. Offered through the convenience and flexibility of the online learning environment, students enroll in two 3-credit courses per 12-week term.

Graduate Certificate of Professional Studies in Beekeeping (Z088)
In this 12-credit certificate, students learn about the anatomy, physiology, and ecology of

the honeybee, how to construct and maintain a hive, and best practices for maintaining a healthy colony.

Graduate Certificate of Professional Studies in Integrated Pest Management (IPM) (Z089)
In this 12-credit certificate, students learn the techniques of Integrated Pest Management (IPM), an effective and environmentally conscientious approach to pest management. Students learn about the life cycles of insects and their interaction with the environment to determine the most effective pest control methods while taking in consideration the effects of treatments to local ecosystems.

Graduate Certificate of Professional Studies in Organic and Sustainable Agriculture (Z090)
In this 12-credit certificate, students learn about sustainability through examining both the ecosystem services provided by beneficial insects, as well as the management of injurious insects.

Graduate Certificate of Professional Studies in Urban Agriculture (Z091)
In this 12-credit certificate, students learn the skills required to maintain plants and beneficial insects within and around cities and about the urban ecosystem, policies, and plans.

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/entomology

Courses:

Applied Mathematics & Statistics, and Scientific Computation (AMSC)

Abstract

The interdisciplinary program in Applied Mathematics & Statistics, and Scientific Computation (AMSC) offers graduate study leading to Master of Science and Doctor of Philosophy degrees with concentrations in applied mathematics, applied statistics, or scientific computation. It also offers a Certificate in Scientific Computation to graduate students enrolled in other university Ph.D. programs. The faculty is drawn from departments throughout the university. Possible areas of application include the physical, chemical, biological, and social sciences, and engineering. The program receives substantial support from the Department of Mathematics (MATH), the Center for Scientific Computation and Mathematical Modeling (CSCAMM), and the Institute for Physical Science and Technology (IPST). AMSC offers a spectrum of courses at the forefront of computation and applications, as well as state-of-the-art computational, visualization and networking facilities.

The Concentration in Applied Mathematics trains individuals who are able to enhance their understanding of a wide spectrum of scientific phenomena through the application of rigorous mathematical analysis. At least half of the required work is expected to be in courses with primarily mathematical content; the remaining courses must apply to a field outside of the usual mathematics curriculum. Graduate students currently pursue studies

Faculty:

Director
Trivisa, Konstantina

Distinguished Scholar-Teacher
Benedetto, John J.

Distinguished University Professor
Alexander, Millard H.
Antman, Stuart S.
Bentley, William E.
Ephremides, Anthony
Freidlin, Mark I.
Kalnay, Eugenia E
Ott, Edward
Tadmor, Eitan

Professor
Agrawala, Ashok K.
Ayyub, Bilal M.
Azarm, Shapour
Balachandran, Balakumar
Balan, Radu
Ball, Michael O.

in the applications areas such as meteorology, algorithm development, pattern recognition, operations research, mathematical finance, computational dynamics, structural mechanics, mathematical biology, and systems and control theory. Other areas of study are available through participating departments. All students must include numerical analysis or scientific computing courses in their programs.

The Concentration in Applied Statistics emphasizes acquisition of advanced training in the area of statistical application along with statistical topics and development of mathematical and computing skills necessary for the modern applied statistician. Students are required to take a series of core statistical and computational courses with more emphasis on data analytics and presentation skills. In addition, students will take a minimum of six credits in an outside application area.

The Concentration in Scientific Computation emphasizes the application of computation to the physical sciences, life sciences, engineering, business, and social sciences. Students will receive training in the use of computational techniques and associated information technology with correspondingly less emphasis on formal mathematical methods in comparison to the Concentration in Applied Mathematics. Every Scientific Computation student is required to apply the training in computation to a problem in a specific scientific discipline.

A master's degree program in all concentrations with an emphasis on numerical analysis, computational methods, probability and statistics is excellent preparation for industrial or government employment.

Admissions Information

In addition to the Graduate School requirements, applicants are required to take the GRE general examination. The applicants are encouraged to take the GRE subject examination in either mathematics or some other scientific topic. Applicants should have at least a "B" average (3.0 on a 4.0 scale) and should have completed an undergraduate program of study that includes a strong emphasis on rigorous mathematics, preferably through the level of advanced calculus and matrix theory.

Admission will be based on the applicant's ability to do graduate work in either applied mathematics, applied statistics, or scientific computation as demonstrated by the letters of recommendation, grades in coursework, and program of study. In some circumstances, a provisional admission may be given to applicants whose mathematical training is not sufficiently advanced. Previous education in an application area such as physics, biology, economics or one of the engineering disciplines, and a basic competence in computational techniques will be favorably considered in a student's application, although this is not a prerequisite.

When a student has decided upon an area of specialization, an advisory committee is formed and approved by the AMSC Graduate Committee. The advisory committee is responsible for formulating with the student a course of study that leads toward the degree sought. This course of study must constitute a unified, coherent program in an acceptable field of specialization of applied mathematics, applied statistics, or scientific computation.

Application Deadlines

Fall:
Applications and supporting documents must be received by February 1 (**January 10 preferred**) .
Spring:
Applications and supporting documents must be received by October 1 (**September 15 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Baras, John S.
Barg, Alexander
Bernard, Peter S.
Blankenship, Gilmer L.
Boyle, Michael
Bruck, Hugh Alan
Calabrese, Richard V.
Carton, James A.
Cerrai, Sandra
Chellappa, Ramalingam
Coale, Frank J.
Cohen, Avis H.
Cramton, Peter
Czaja, Wojciech
Davis, Larry S.
Desai, Jaydev
Dorr, Bonnie J.
Dubayah, Ralph O.
Duncan, James H.
Einstein, Theodore L.
Elman, Howard C.
Fagan, William F.
Fitzpatrick, Patrick M.
Forni, Giovanni
Fu, Michael C.
Gabriel, Steven A.
Gasarch, William
Gates, Sylvester James, Jr.
Glaz, Harland M.
Golden, Bruce L.
Goldman, William M.
Greenberg, Oscar Wallace
Grillakis, Manoussos
Hadley, Nicholas John
Hassam, Adil B.
Hu, Bei-Lok
Hunt, Brian R.
Jabin, Pierre-Emmanuel
Jacobs, David
Katz, Jonathan
Kedem, Benjamin
Krishnaprasad, P.S.
Lahiri, Partha
Lee, Mei-Ling Ph.D., University of Pittsburgh, 1980
Lee, Sung W.
Levermore, Charles D.
Levy, Doron
Liu, K.J. Ray
Madan, Dilip B.
Makowski, Armand M.
Marcus, Steven I.
Margetis, Dionisios
Mayergoyz, Isaak
Mount, David M.
Narayan, Prakash
Newcomb, Robert W.
Nochetto, Ricardo H.
O'Leary, Dianne P.
Oard, Douglas William
Okoudjou, Kasso A.
Pecht, Michael G.
Prucha, Ingmar R.
Raghavan, Subramanian
Reggia, James A.
Reynolds, Christopher
Rosenberg, Jonathan M.
Shamma, Shihab A.
Shapiro, Benjamin
Shayman, Mark A.
Slud, Eric Victor
Srinivasan, Aravind
Thirumalai, Devarajan
Tits, Andre L.
Trivisa, Konstantina
Vishkin, Uzi
Washington, Lawrence C.
Wedel, Michel

1. GRE General, (GRE Subject-Optional)
2. 3 Letters of Recommendation

Degree Requirements

Doctor of Philosophy (Ph.D.)
For the Ph.D. degree, the student must fulfill the coursework requirement of the corresponding concentration and pass a set of comprehensive written examinations at the Ph.D. level. In addition, the student must pass the Oral Candidacy Examination, which tests the student on advanced material to determine if he or she is prepared to do the research for a doctoral dissertation. At least 12 credits of dissertation work are required. The doctoral student must also participate in at least two semesters in the Applied Mathematics Seminar.

All M.S. and Ph.D. students must take at least one semester of numerical analysis. Details on the level and distribution of coursework and examinations in mathematics and in the applications area are given on the program web site:http://www.amsc.umd.edu/.

Master of Science (M.S.)
For the master's degree, the program offers a thesis and non-thesis option. For Applied Mathematics and Scientific Computation concentrations, in the thesis option, 24 credits of coursework are required with at least 6 more credits of thesis work. In the non-thesis option for these two concentrations, 30 credits of coursework are required and the student must pass a set of comprehensive examinations. A scholarly paper is also required. In both options, the student must participate at least one semester in the Applied Mathematics seminar. For Applied Statistics concentration, in the thesis option, 25 credits of coursework are required including one seminar credit, with at least 6 more credits of thesis work. In the non-thesis option, 33 credits of coursework are required including two seminar credits and the student must pass a set of comprehensive examinations. A scholarly paper is also required.

Facilities and Special Resources

There are over 25 participating departments and institutes on the College Park campus, including units in the College of Computer, Mathematical, and Natural Sciences and the School of Engineering. The university has an engineering technical library as well as a network of high performance workstations for faculty and graduate students. In addition, there are collaborations with various area research institutes such as NASA Goddard Space Flight Center, National Institutes of Health, National Institute of Standards and Technology, Naval Research Laboratory, and National Oceanic and Atmospheric Administration.

Financial Assistance

The program offers teaching assistantships in the Department of Mathematics as a source of support for graduate students. These assistantships carry a stipend with remission of tuition of up to 10 credit hours each semester. Research assistantships are also available through participating departments and other sources, especially for students that have acquired advanced training. Assistantships are usually available only to incoming Ph.D. students; applications including letters of recommendation should be completed by January 10 for full consideration.

Contact Information

For more specific information, contact:

Alverda McCoy, Program Coordinator
3103 Mathematics Building,
College Park
MD 20742

Zachariah, Michael R.
Zhang, Da-Lin

Associate Professor
Akin, David L.
Alt, Francis B.
Austin, Mark A.
Baeder, James D.
Coughlin, Peter J.
Cummings, Michael P.
Dorland, William D.
Duraiswami, Ramani
Evans, Michael N.
Girvan, Michelle
Harring, Jeffrey R.
Herrmann, Jeffrey W.
Horiuchi, Timothy K.
Ide, Kayo
Jank, Wolfgang
Kingsford, Carl
La, Richard
Li, Yan
Lovell, David J.
Mellet, Antoine
Momen, Bahram
Montesi, Laurent G. J.
Neustadtl, Alan
Paley, Derek
Pop, Mihai
Sanner, Robert
Smith, Paul J.
Song, Jiuzhou
Swistak, Piotr T.
Zhu, Wenlu
von Petersdorff, Tobias

Assistant Professor
Barnes, Sean
Bedrossian, Jacob
Butts, Daniel
Cameron, Maria
Corrada Bravo, Hector
Hahn, Jin-Oh
He, Xin
Hier-Majumder, Saswata
Lekic, Vedran
Liao, Yuan
Mankad, Shawn
Miyoshi, Takemasa
Rand, William
Rhyzhov, Ilya

Senior Research Scientist
Fox-Rabinovitz, Michael
Gumerov, Nail A.

Associate Research Professor
Deane, Anil E.

Research Associate Professor
Zimin, Aleksey

Research Professor
Kishek, Rami Alfred
Valliant, Richard L.
Wallace, Stephen J.

Research Assistant Professor
Kiemel, Timothy L.

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Courses: AMSC

Related Programs and Campus Units

Mathematics
Mathematical Statistics
Engineering: Electrical & Computer Engineering
Biological Sciences
Computer Science
Engineering: Mechanical Engineering
Engineering: Aerospace Engineering
Economics
Physics
Geology
Business and Management:Doctoral Programs
Animal Sciences
Astronomy
Engineering: Civil and Environmental Engineering
Engineering: Chemical Engineering
Decision and Information Technologies
Epidemiology and Biostatisics
Government and Politics
Atmospheric and Oceanic Science

Architecture (ARCH)

Abstract

The School of Architecture, Planning and Preservation offers a graduate program leading to the National Architectural Accrediting Board (NAAB) accredited Master of Architecture degree. The Architecture Program (ARCH) seeks to change the world through innovative architectural and urban design pedagogies, research, and practice that transforms place at all scales and improves the quality of life. In the course of our mission, we instigate change through teaching, experience, and scholarly activity, which prepares the next generation of broadly educated, highly-skilled architects and designers to be problem seekers/solvers in collaborative learning and professional environments. The Program offers a rich and demanding mix of architectural and urban design studios, architectural history and theory, and architectural science and technology. Electives in architecture and related fields are available in the curriculum.

NAAB Required Statement on Accreditation:
In the United States, most registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit professional degree programs in architecture offered by institutions with U.S. regional accreditation, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted an eight-year, three-year, or two-year term of accreditation, depending on the extent of its conformance with established educational standards.

Doctor of Architecture and Master of Architecture degree programs may require a pre-professional undergraduate degree in architecture for admission. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Affiliate Assistant Professor
Hier-Majumder, Saswata

Lecturer
Lele, Shreevardhan

Distinguished University Professor Emeritus
Yorke, James A.

Professor Emerita
Yang, Grace L.

Faculty:

Dean
Cronrath, David

Director
Kelly, Brian Paul

Assistant Director
Ambrose, Michael A.

Professor
Bell, Matthew J.
Cronrath, David
Hurtt, Steven W.
Kelly, Brian Paul
Rockcastle, Garth C.
Vann, Robert L.

Associate Professor
Bovill, Carl H.
Eisenbach, Ronit
Gardner, Amy E.
Gournay, Isabelle J.
Simon, Madlen G.

Assistant Professor
Koliji, Hooman
Vandergoot, Jana

Professor of Practice
Noonan, Peter

The University of Maryland School of Architecture, Planning & Preservation offers the following NAAB-accredited degree programs:

M.Arch (pre-professional degree + 60 graduate credits)

M.Arch (non-pre-professional degree + 109 credits)

Next accreditation visit for both programs: 2017

The School is a member of the Association of Collegiate Schools of Architecture (ACSA) and the Architectural Research Centers Consortium (ARCC).

Professor Emeritus
Bechhoefer, William B.
Bennett, Ralph D., Jr.
Du Puy, Karl F.G.
Etlin, Richard A.
Fogle, David P.
Francescato, Guido
Hill, John W.
Lewis, Roger K.
Loss, John C.
Schlesinger, B. Frank

Admissions Information

Admission to the graduate program is competitive. In addition to the Graduate School requirements, candidates must submit a portfolio. The portfolio should show evidence of creative ability in the form of a portfolio containing reproductions of creative work, which may include drawings, paintings, photographs, sculpture, sketches, and/or architectural designs. Details concerning format and content may be obtained from the School of Architecture, Planning and Preservation website at http://www.arch.umd.edu.

Applications from four categories will be considered for admission: 1) candidates with a four-year Bachelor of Science in architecture degree; 2) candidates with four-year baccalaureate (B.A.) in architecture, environmental design (B.A. or B.S.), or relevant discipline; and 3) candidates with four-year baccalaureate (B.A. or B.S.) in a major other than architecture who have successfully completed specified undergraduate prerequisites outlined by the School of Architecture, Planning, and Preservation*; and 4) candidates with an accredited professional degree in architecture. Students are expected to enroll on a full-time basis. For complete information on curricula requirements for these categories, visit the School of Architecture, Planning and Preservation website at http://www.arch.umd.edu.

*Additional requirements include: one (1) semester of college level calculus or successful high school advanced placement (AP) calculus; and one (1) semester of college level physics with lab, or successful high school advanced placement (AP) in physics. One (1) course in freehand figurative drawing is recommended but not required.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. Statement of Purpose
2. Graduate Record Examination (GRE)
3. Transcript(s)
4. Letters of Recommendation (3)
5. CV/Resume
6. Portfolio
7. TOEFL/IELTS/PTE (international applicants only)

Degree Requirements

Ph.D. in Urban and Regional Planning and Design (Ph.D.)
The School of Architecture, Planning, and Preservation offers a Doctoral Program, the Ph.D. in Urban and Regional Planning and Design. Participating programs include Urban Studies and Planning, Architecture, Historic Preservation, Landscape Architecture, and

The National Center for Smart Growth Research and Education. The program prepares students to teach at the university level in departments of Urban Planning, Architecture, Historic Preservation, or Landscape Architecture, as well as qualifies graduates to conduct research and participate in high-level decision-making in the public, private, and nonprofit sectors.

Master of Architecture and Real Estate Development (dual degree) (ARDV)
The dual degree combines course work from the Architecture and Real Estate Development programs to enable a student to complete both the Master of Architecture and Master of Real Estate Development degrees with fewer credits than it would take to complete the two separately. For more information on the Master of Real Estate Development degree program go to the catalog entry for RDEV. Also be advised that that there may be a differential tuition established for this program which will be applied to any courses taken after approval of such differential if and when approved by the University.

Master of Architecture and Community Planning (dual degree) (ARCP)
The dual degree combines course work from the Architecture and Urban Studies and Planning programs to enable a student to complete both the Master of Architecture and Master of Community Planning degrees with fewer credits than it would take to complete the two separately. Students of the dual-degree program acquire specialized knowledge tailored to understanding the urban environment from several perspectives. Students learn how social, economic,and political forces have led to the development of human habitats. The emphasis on urban design in the dual-degree program yields an education that is particularly applicable for persons interested in the revitalization of metropolitan areas and their center cities.

Master of Architecture and Historic Preservation (dual degree) (ARHP)
The dual degree combines course work from the Architecture and Historic Preservation programs to enable a student to complete both the Master of Architecture and Master of Historic Preservation degrees with fewer credits than it would take to complete the two separately.

Master of Architecture (M.Arch.)

Students entering the program with a four-year Bachelor of Science degree in Architecture from an accredited college or university normally require two years of graduate study to complete the requirements for the professional Master of Architecture degree. The established curriculum requires four semesters of academic work encompassing a total of 60 credits. Additional credits may be required depending upon the admissions committee's evaluation of the individual's academic and architectural experience. Information on required courses and curriculum may be obtained from the School of Architecture, Planning and Preservation website at http://www.arch.umd.edu.

Students who enter the professional program with a B.A. or B.S. in a discipline other than architecture will normally require seven semesters of design studio and other prerequisite courses encompassing a total of 109 credits. Students may be granted advanced standing if they have completed the appropriate prerequisites and provide documentation prior to matriculation. Information on required courses, the curriculum, and advanced standing may be obtained from the School of Architecture, Planning and Preservation website at http://www.arch.umd.edu.

A program leading to a Master's Certificate in Historic Preservation is available to M. Arch and M.S. in Arch candidates. The course of study includes 24 credits and an approved thesis, which may satisfy requirements of both the Architecture and Preservation curricula.

A program leading to a Masters Certificate in Urban Design is available to M. Arch and M.S. in Arch candidates. The course of study includes 24 credits and an approved thesis.

Master of Science in Architecture (M.S. Arch)
A special option leading to the Master of Science in Architecture degree is available for

those students who already possess an accredited NAAB professional degree in architecture (B ARCH, M ARCH, or D ARCH) or its foreign equivalent. This option is designed to accommodate the needs of students who wish to do advanced work beyond that required for the professional degree. Applicants must specify in detail the nature of the proposed course of study for review and approval by the admissions committee prior to their admission. The School currently provides resources for advanced work in architectural design and urban design.

Facilities and Special Resources

The School of Architecture, Planning, and Preservation is ideally located between Washington, DC, and Baltimore and surrounded by a number of historic communities and a varied physical environment. The resulting opportunity for environmental design study is unsurpassed. The School's resources include design workstations for each student, a model shop, a digital fabrication lab, and computer labs. The School's library contains some 57,000 monographs and 6,000 current periodicals, making it one of the major architectural libraries in the nation. The National Trust Library for Historic Preservation, housed in McKeldin Library, contains 11,000 volumes and 450 periodical titles. The slide collection includes approximately 430,000 slides on architecture, landscape architecture, planning, and technical subjects. The interdisciplinary National Center for Smart Growth Education and Research is based in the School offering perspectives and opportunities to engage important issues facing urban and regional planning.

The Architecture Program benefits from the strong support of the professional community, including practitioners who bring expertise into the architectural design studios as instructors, consultants, and critics. Many alumni are leaders in regional firms, while others practice as far away as New York, Los Angeles, Puerto Rico, Vancouver, London, and Shanghai.

The University of Maryland's team has won the ULI/Hines Competition for two consecutive years, with each member of the team being awarded $10,000.

The award-winning Comprehensive Design Studio and Advanced Technology sequence (an integral component of the M. Arch curriculum) offers an innovative teaching-learning environment where students work with an array of consultants from practice, exploring relationships between conceptual and technical aspects of architectural form and its assembly.

Embracing the importance of context as an integral component of the design process and advocating urban design as an essential component of architectural education, the Program has gained national and international recognition for its work in urban design, through awards and competition performance. Interdisciplinary competitions like the Urban Land Institute (ULI) Hines Urban Design Competition give architecture students opportunities to team up with fellow graduate students in planning, historic preservation, and real estate development to address urban issues in a work environment that prepares them for the collaborative experience of professional practice. In both 2014 and 2015 the University of Maryland's ULI-Hines competition team took first place in international competition bringing back over $50,000 in scholarship monies each time. The Urban Design Studio explores relationships between individual buildings, urban spaces, and the contexts in which they reside. Studios engage projects ranging from conceptual urban interventions to projects that help communities to envision future growth.

Study abroad opportunities augment the course of study offered in College Park. Summer and Winter study abroad programs are offered to a variety of locations including Rome, Paris, Scandinavia, Great Britain, Turkey, St. Petersburg, Egypt, Peru, and Sri Lanka. Summer and winter study opportunities are also available in conjunction with the Historic Preservation, Urban Studies & Planning, and Real Estate Development programs. A Spring Semester study abroad program is based at Kiplin Hall in Great Britain.

Financial Assistance

The School of Architecture, Planning, and Preservation offers a limited and varying number of teaching and research assistantships, scholarships, fellowships, and internships. Applicants should apply for financial assistance when submitting the application for admission.

Contact Information

Find additional information on program offerings, degree requirements, admissions, and financial aid on the School's Web site (www.arch.umd.edu).

Schedule a visit and tour online at: http://arch.umd.edu/arch/prospective-students-arch

Sign up to receive an invitation to our Graduate Open House and recieve more information online at: http://arch.umd.edu/mapp/graduate-inquiry-form

For further information on admissions and degree requirements, please contact Brian Kelly, AIA, Architecture Program Director, archadvise@umd.edu, 301-405-8000.

Brian Kelly, AIA, Director, Architecture Program
University of Maryland School of Architecture, Planning and Preservation Building 145
College Park
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http://www.arch.umd.edu

Courses: RDEV HISP URSP ARCH

Related Programs and Campus Units

Urban Studies and Planning
Historic Preservation
Urban and Regional Planning and Design
Real Estate Development
Landscape Architecture

Architecture and Real Estate Development (ARDV)

Faculty:

Dual degree programs, such as Architecture and Real Estate Development, can have complicated requirements and applications. It is recommended that you consult with the Program Directors of each program before proceeding to apply.

Application deadlines for the program are December 15 for International Applicants and January 1 for the Domestic Applicants. If you miss the deadline, you may apply and be considered for the real estate development program for August, but would have to apply for the Architecture part of the dual degree program in the year following.

The School has requested a differential tuition for in-state students in order to defray the higher cost of offering the dual degree program. The tuition differential, if approved, will be announced to all enrolled students, and will only be applied going forward for the semester following the announcement.

Abstract

There are several paths, depending on prior education and experience for applicants to consider for Architecture as well as for Real Estate Development. Students applying for the dual degree program will complete fewer courses (permitted overlap of courses) than if they took each degree program separately. The total number of credits for the dual degree is 75 credits for Path A architecture/real estate development dual degree students (those with undergraduate degree credits fully accepted) and is 127 credits for Path B architecture/real estate development dual degree students (those without an undergraduate degree in architecture). For the most complete information on the architecture program, also consult the catalog entry for ARCH. For the most complete information on the real estate development program, also consult the catalog entry for RDEV.

Admissions Information

The application process consists of the following:

First, fill out the on-line application for the University of Maryland Graduate School. The administrative code for the dual degree in Master of Architecture degree and Master of Real Estate Development is "ARDV."

Second, submit all transcripts, three professional letters of recommendation, statement of purpose, resume, official test scores, portfolio, and writing sample as part of the application.

All applicants must have a bachelor's degree from an accredited institution. There is no restriction on the applicants' previous field of study, and indeed we encourage diversity in all senses.

Application Deadlines

Application Requirements

1. Statement of Purpose
2. Graduate Record Examination (GRE)
3. Transcript(s)
4. Letters of Recommendation (3)
5. CV/Resume
6. Portfolio
7. Writing Sample

Degree Requirements

Architecture and Real Estate Development (Dual Degree) (M. Arch)

Students entering the program with a four-year Bachelor of Science degree in Architecture from an accredited college or university normally require 75 credits which can be completed in five semesters plus one Summer and one Winter term course. Additional credits may be required depending upon the architectural admissions committee's evaluation of the individual's academic and architectural experience. Information on required courses and curriculum may be found on the School of Architecture, Planning and Preservation website at http://www.arch.umd.edu.

Students who enter the professional program with an undergraduate degree in a discipline other than architecture (Path B) will normally require eight semesters plus course work in two summer and two winter terms in order to complete the 127 credits required for the dual degree in architecture and real estate development. Students may be granted advanced standing if they have completed certain of the required architecture prerequisites. Information on required courses and curriculum may be found on the School of Architecture, Planning and Preservation website at http://www.arch.umd.edu.

Facilities and Special Resources

The School of Architecture, Planning and Preservation and the Colvin Institute of Real Estate Development are ideally located between Washington, DC, and Baltimore and surrounded by a number of historic communities and a varied physical environment. The resulting opportunity for real estate development and environmental design study is unsurpassed.

The School's resources include design workstations for each architecture student, a model shop, a digital fabrication lab, and both PC and MAC computer labs with REVIT, ARGUS, GIS, Maptitude and other design programs available. The School's library contains some 57,000 monographs and 6,000 current periodicals, making it one of the major architectural libraries in the nation. The National Trust Library for Historic Preservation, housed in McKeldin Library, contains 11,000 volumes and 450 periodical titles. The Colvin Institute holds the entire library offerings of the Urban Land Institute and access to all the case studies published by ULI. The interdisciplinary National Center for Smart Growth Research and Education, based in the School, offers perspectives and opportunities to engage important issues facing urban and regional planning.

Both the Real Estate Development and Architecture Programs benefit from the strong support of the professional community, including practitioners who bring expertise into the architectural design studios as instructors, consultants, and critics. The RDEV courses are all taught by working or retired real estate professionals giving unparalleled access for students to make connections with current practice in the industry. Many architecture alumni are leaders in regional firms, while others practice as far away as New York, Los Angeles, Puerto Rico, Vancouver, London, and Shanghai.

The ULI Hines competition is open to graduate students who are pursuing real estate-related studies at universities in the United States and Canada, including programs in real estate development, urban planning, urban design, architecture and landscape architecture. In the past six years, the University of Maryland has reached the ULI Hines finals four times, won twice (2014 & 2015) and received one honorable mention.

The award-winning Comprehensive Design Studio and Advanced Technology sequence (an integral component of the M. Arch curriculum) offers an innovative teaching-learning environment where students work with an array of consultants, exploring relationships between conceptual and technical aspects of architectural form and its assembly.

Embracing the importance of context as an integral component of the design process and advocating urban design as an essential component of architectural education, the Program has gained national and international recognition for its work in urban design, through awards and competition performance. Dual degree students are prime candidates for selection to participate in the interdisciplinary competitions supported by the School, including the national ULI Hines, the regional REIDO development competition, and the local capital area competition sponsored by NAIOP which gives the team the opportunity to present a urban (re)development solution to a large professional audience of real estate and design professions.

Study abroad opportunities augment the course of study offered in College Park. Summer study abroad programs are offered to a variety of locations including Rome, Paris, Scandinavia, Great Britain, Turkey, St. Petersburg, Egypt, Peru, and Sri Lanka. Summer and winter study opportunities are also available in conjunction with the Historic Preservation, Urban Studies & Planning, and Real Estate Development programs. A Spring Semester study abroad program is based at Kiplin Hall in Great Britain.

Dual degree students have the option to do their M.Arch thesis and MRED Capstone project in a combined fashion, with a design and development proposition supported by a committee of design and development instructors and professional advisors. These are very challenging and rewarding for students and faculty alike, but require a fair amount of advance planning on the part of both the student and faculty.

Financial Assistance

The School of Architecture, Planning, and Preservation offers a limited and varying number of teaching and research assistantships, scholarships, fellowships, and internships. Applicants should apply for financial assistance when submitting the application for admission.

The Colvin Institute provides scholarship funds to a number of highly qualified students, who may be dual degree students each term. Scholarship determinations are made at the time of application and admission. Scholarships are generally awarded on a per course basis and commitments are made at the time of admission and apply to the entire program, subject to academic performance. Periodically there are named scholarships provided by various real estate organizations or development companies.

In addition, there are work opportunities both on, and off campus, and they are relatively plentiful. However, students in the dual degree program may find it impossible to complete their degree requirements timely if they are working off campus, or more than 10 hours per week. However, the MRED student listserv posts openings periodically as they are brought to the attention of the Program by alumni, friends, faculty and sponsors.

Applicants should inquire as to the availability of funding for the term they are starting. Colvin Institute scholarships are typically for a portion of tuition only, and are paid on a per course basis as students progress through the program.

Contact Information

Find additional information on program offerings, degree requirements, admissions, and financial aid on the School's Web site (www.arch.umd.edu).

Schedule a visit and tour online at: http://arch.umd.edu/arch/prospective-students-arch. Be sure to contact the Program Director for Real Estate Development, Margaret McFarland, (mmcf@umd.edu) if you wish to attend a sampling of RDEV classes while here.

Sign up to receive an invitation to our Graduate Open House online at: http://arch.umd.edu/mapp/graduate-inquiry-form

For further information about the Architecture Program, please contact Brian Kelly, AIA, Director, archadvise@umd.edu, 301-405-8000.

For further information about the Real Estate Development Program and the Colvin Institute, please contact Margaret McFarland, JD, Director, mmcf@umd.edu, 301-405-8000.

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Courses:

Related Programs and Campus Units

Urban Studies and Planning
Historic Preservation

Art History and Archaeology (ARTH)

Abstract

The Department of Art History and Archaeology offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees in Art History. The Program is committed to the advanced study and scholarly interpretation of works of art from the prehistoric era to the present and is grounded in the concept of art as a humanistic experience. The faculty offers expertise in all phases of the history of Western art as well as the arts of Africa, the Americas, and East Asia.

Admissions Information

For admission to the Master's program, students should have an undergraduate degree from an accredited college or university, or its equivalent. Although the applicant must demonstrate a general knowledge of art history, an undergraduate major in art history is not required. Students are required to submit the Graduate Record Examination scores for admission.

Application Deadlines

Fall:
Applications must be received by December 12th .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. TOEFL/IELTS (international graduate students)
3. Transcripts
4. 3 Letters of Recommendation
5. Statement of Goals & Research
6. Writing Sample
7. CV/Resume

Degree Requirements

Master of Arts (M.A.)
For the Master's degree, the student will: complete 30 credit hours at the 600 and 700 levels (at least 9 of these credits must be 700 level seminars; 6 are for thesis research; and one course must be ARTH 692, Methods of Art History); maintain a grade of B or better in coursework; pass the departmental language examination in French or German, or in a language appropriate to the area studied (such as Japanese); complete a thesis that demonstrates competency in research and in original investigation; and successfully

Faculty:

Chair
Gill, Meredith J.

Professor
Colantuono, Anthony
Hargrove, June E.
Kelly, Franklin W.
Kuo, Jason C.
Mansbach, Steven
Wheelock, Arthur, Jr.

Associate Professor
Ater, Renee
Shannon, Joshua
Suzuki, Yui
Volk, Alicia

Assistant Professor
Gensheimer, Maryl
McEwen, Abigail

Professor Emerita
Venit, Marjorie S.

Professor Emeritus
Denny, Don W.
Pressly, William L.

Associate Professor Emerita
Spiro, Marie
Withers, Josephine

defend the thesis. Please contact the Graduate Secretary for information regarding course distributional requirements.

Doctor of Philosophy (Ph.D.)
A total of thirty-three credit hours, after the M.A. degree, is required for the Ph.D. program. This involves seven courses (21 credit hours), including Methods of Research (ARTH 692) if not previously taken; the final twelve credit hours will be Dissertation Research (ARTH 899). For the direct Ph.D.--in which the M.A. degree is bypassed--the student must complete a total of fifty-seven credit hours, including Methods of Research (ARTH 692) and fourteen other courses, in at least five of the eleven areas specified above in the description of the Master's program; the final twelve credit hours will be Dissertation Research (ARTH 899).

Facilities and Special Resources

The Michelle Smith Collaboratory for Visual Culture, part of the Department of Art History and Archaeology, is designed to foster innovation in teaching and research by combining cutting-edge visual technology with an environment that encourages collaboration among faculty, students, and external scholars. The Collaboratory combines space for work and for meetings with advanced technology and helpful staff to provide a venue in which teachers and students can gather to work, share ideas, and find the resources necessary to explore new technologies and pursue intellectual interests, as well as to promote the department's teaching curriculum. The Department maintains its own Lloyd and Jeanne Raport study collection of some 130 objects from ancient Egypt, Greece, Rome, and the Ancient Americas.

The University Art Gallery, also located in the Art/Sociology Building, maintains a lively and varied exhibition schedule and has a permanent collection of twentieth-century American prints, drawings and paintings, collections of Japanese prints, and African objects.

The Art Library houses approximately 100,000 volumes as well as a vast body of auxiliary material, including about 70,000 sheets of microfiche. In addition to the University's library resources, graduate students have access to the Library of Congress, the Archives of American Art, the libraries of Dumbarton Oaks, and other research facilities in Washington.

The University of Maryland is located in the suburbs of Washington, D.C., and is 30 minutes from the National Gallery of Art and the National Gallery's Center for Advanced Study in the Visual Arts, the Corcoran Gallery, the Phillips Collection, the Hirshhorn Museum and Sculpture Garden, the Smithsonian American Art Museum, the Museum of African Art, the Freer and Arthur M. Sackler Galleries, which are devoted to the art of East Asia, the National Museum of Women in the Arts, and many other major art museums. The campus is a 40-minute drive from such Baltimore institutions as the Walters Art Gallery and the Baltimore Museum of Art.

In order to enhance the student's curricular choices, the Department maintains an arrangement for course exchange with the Art History department of the Johns Hopkins University in Baltimore. To similar effect, the Department is a member of the Washington Area Art History Consortium, which unites the graduate art history departments of the greater Washington area.

The Department organizes a variety of liaison activities with leading cultural institutions in the Washington-Baltimore area. The Middle Atlantic Symposium in the History of Art is sponsored jointly by the Department and the National Gallery of Art; this annual event provides the opportunity for advanced graduate students from universities in the Middle Atlantic region to present their research at a professional forum. Special seminars are frequently given by curators of such local collections as the National Gallery of Art, the Freer Gallery, or the Department of Prints and Photographs at the Library of Congress.

Financial Assistance

Fellowships are awarded on the basis of merit by the College of Arts and Humanities and by the Graduate School. Several graduate assistantships are awarded by the Department. Also, up to four Museum Fellowships are awarded each semester by the Department of Art History and Archaeology for research at major museums in the Washington-Baltimore area. Approximately thirty graduate students are fully supported with stipends and tuition each semester. In honor of its late founding chairman, the Department has established the George Levitine Art History Endowment, in support of research activities of graduate students as well as faculty. The Jenny Rhee Fellowship supports research, travel, and other educational expenses. The Department has recently received a generous gift from the Robert H. Smith family which includes three graduate fellowships. Additional fellowships are available, including travel and dissertation research awards.

Contact Information

For more information on Departmental requirements and any other information, please view the Department's web-site, or contact the Graduate Secretary.

Deborah Down, Graduate Secretary
1211B Art/Sociology Building
College Park, MD 20742
Telephone: (301) 405-1487
Fax: (301) 314-9652
ddown@umd.edu

http://www.arthistory-archaeology.umd.edu

Courses: ARTH

Art Studio (ARTT)

Faculty:

Chair
Richardson, William C.

Associate Professor
Buck, Audra
Craig, Patrick M.
Elahi, Hasan
Gavin, Dawn
Humphrey, Margo
Kehoe, Patrice I.
Klank, Richard E.
Morse, Brandon
Ruppert, John
Sham, Foon V.
Thorpe, James G.

Assistant Professor
Collis, Shannon
Strom, Justin

Abstract

The Department of Art offers a program of graduate study leading to the Master of Fine Arts degree. The program emphasizes independent and interdisciplinary work. The Graduate Faculty consists of 15 active professional artists specializing in a range of studio and post-studio practices, including painting/drawing, sculpture/installation, printmaking, digital and time-based media. The program is small and competitive, and most students receive support in the form of graduate fellowships and assistantships, which include teaching and after-hours studio monitoring.

Admissions Information

To apply to the MFA Program applicants are encouraged to complete the Graduate School application available online at https://app.applyyourself.com/AYApplicantLogin/fl_ApplicantConnectLogin.asp?id=umdgrad. Applicants are also required to pay the requisite appliation fee.

For admission to the graduate program, The Department of Art requires an undergraduate degree with a major in art from an accredited college or university, or its equivalent. A minimum of 30 credit hours of undergraduate work in studio courses and 12 credit hours in art history courses is recommended.

The MFA Degree is the final degree in studio art. Only the highest level of undergraduate artistic achievement is appropriate for graduate application. The Department of Art seeks students who have developed coherent bodies of work that are personal and focused.

This body of art work, as professionally documented on CD's, Videos or websites is the primary basis for admittance.¬

Application Deadlines

Fall:
Applications must be received by January 16 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

- No Tests
- 3 Letters of Recommendation
- 1 set of complete transcripts reflecting undergraduate and graduate work
- 20 Digital Images, website/software or videos/videos documentation

(Work samples are submitted through slideroom. For instructions on how to submit portfolio submissions go to http://umdart.slideroom.com.)

Degree Requirements

Master of Fine Arts (M.F.A.)
Candidates for the Master of Fine Arts Degree must complete a program that consists of 60 credit hours. These 60 credit hours are distributed as follows: 30-33 credits in Studio; 0-3 credits Teaching Internships; 6 credits in Art History/Art Theory; 12 credits in Graduate Colloquium; and 9 credits in Masters Thesis Research. Graduate Reviews, with committees made up of Graduate faculty members, take place at the end of each semester. Each MFA candidate in his/her final semester must select a thesis advisor and a thesis committee. Students must present their artwork in a Thesis Exhibition, usually installed in the Art Gallery at a designated time near the end of the spring semester. Students must also develop a written component to the Thesis (These have varied in length from five to 50 pages), and present an oral defense of the Thesis to the Thesis committee.

Facilities and Special Resources

Each MFA student is provided with 24-hour access to an individual studio. Each studio is approximately 400 sq. ft. The studios are adequately ventilated and meet industry standards in safety. General sculpture facilities include: Approximately 2200 sq. ft. wood shop; approx. 2200 sq.ft. steel fabrication studio; approx. 1500 sq. ft. foundry w/indoor furnace plus outdoor furnace for iron casting. There is space within the building, and outside on the grounds, for sculpture and installations. The printmaking studio (screen, intaglio, relief/litho, digital) is approximately 3000 sq. ft. There are also approx. 8000 sq. ft. of undergraduate painting and drawing studios. Digital media features up to date Macs, large format printers, a CNC router, laser cutter/engraver, and two maker-bot 3D printers. The department encourages multi-media and interdisciplinary approaches to technology.

Within the building housing the Department of Art, there are two galleries and two libraries. The University of Maryland Art Gallery, an independent unit that works closely with the Department of Art, features national and international contemporary and historical exhibitions as well as faculty and annual MFA Thesis shows. The Herman Maril Art Gallery is a student organized gallery that features student exhibitions, lectures, special projects and a space for social activities. The Art Library, separate from the large

research libraries on campus, has an outstanding collection of books, catalogues, periodicals and reproductions, all indexed on computer and CD ROM systems.

Financial Assistance

The Department offers eight teaching assistantships and one fellowship. A number of Graduate School Fellowships are also available. Applications should be submitted by January 16 for consideration for a graduate assistantship or fellowship.

Contact Information

The Department of Art website, www.art.umd.edu provides a lot of information for prospective students. For further information, contact:

Danielle M. Curtis,MFA Administrative Assistant
University of Maryland College Park Department of Art
rm. 1211E Art/Sociology Building #146
MD 20742-1311
Telephone: (301) 405-1445
DCurtis2@umd.edu

http://www.art.umd.edu

Prof. Justin Strom, Graduate Director
University of Maryland College Park: Department of Art
Rm.1211E Art-Sociology Bldg #146
MD 20742-1311
jstrom@umd.edu

Courses:

Astronomy (ASTR)

Abstract

The Department of Astronomy offers programs of study leading to the Master of Science and Doctor of Philosophy degrees. A full schedule of courses covering most fields of astronomy is offered. Some areas in which the faculty focus their research efforts are comets, interplanetary dust, planetary dynamics, extrasolar planets, star and planet formation, mm wavelength astronomy, the interstellar medium, black holes, active galaxies, time-domain astronomy, galaxy formation and evolution, plasma astrophysics, high energy astrophysics, theoretical and computational astrophysics, and cosmology.

Admissions Information

Because of the large number of qualified applicants, the Department of Astronomy has had to restrict formal admission to the Graduate School to those who have shown particularly outstanding work in their undergraduate records. Students who enter the graduate program are normally expected to have strong backgrounds in astronomy, physics, and mathematics. A student with deficiencies in one of these areas may be admitted but will be expected to remedy such deficiencies as soon as possible.

Note that the Department of Astronomy accepts applications for the Ph.D. program only. (Admitted students typically receive an M.S. degree after their second year in the program.)

Faculty:

Chair
Vogel, Stuart N.

Professor
Deming, Leo Drake
Hamilton, Douglas P.
Harris, Andrew I.
Miller, M. Coleman
Mundy, Lee G.
Mushotsky, Richard
Papadopoulos, Konstantinos Dennis
Reynolds, Christopher
Richardson, Derek C.
Sunshine, Jessica M.
Veilleux, Sylvain
Vogel, Stuart N.

Associate Professor
Bolatto, Alberto D.
Ricotti, Massimo

Assistant Professor
Boylan-Kolchin, Michael
Gezari (Stock), Suvi

Research Professor
A'Hearn, Michael F.

Application Deadlines

Fall:
Both Domestic and International Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Graduate application
2. Statement of purpose
3. Description of research
4. List of publications and presentations
5. Supplementary application (a brief questionnaire)
6. Transcripts (translated into English). You must have an overall grade point average of 3.0. An unofficial transcript is sufficient; upon enrollment, students are asked to submit hard copies of official transcripts to the University.
7. Three letters of recommendation
8. GRE General and Physics Subject Test scores (University of Maryland institution code is 5814). See here for exceptions.
9. TOEFL or IELTS test scores (international applicants). See the ISSS website and also here for exceptions.
10. Non-refundable application fee ($75). See here for exceptions.
11. International applicants must submit the Certification of Finances form. Note that the Department guarantees a graduate assistant position to all incoming students, which you can use to satisfy the financial certification.

Degree Requirements

Doctor of Philosophy (Ph.D.)

Course requirements for the PhD in Astronomy currently consist of eight courses, at least six of which must come from the nine principal Astronomy graduate courses 601, 606, 610, 615, 620, 622, 630, 670, and 680. A qualifying exam based on these courses is given in the summer after the second year. A research project is required of all students in the second year of graduate study. Admission to the PhD program is based on course work, the research project and the qualifier.

Students choose a research stream depending on their interest within the field. Courses beyond the required eight are sometimes necessary for advanced research. This will be assessed by the student's thesis committee.

Master of Science (M.S.)

Candidates for the non-thesis option of the M.S. degree are required to complete 30 credits. 18 credits will come from six of the nine principal Astronomy graduate courses (601, 606, 610, 615, 620, 622, 630, 670, and 680), with the remaining 12 credits consisting of classroom courses or research credits in Astronomy or supporting fields. One or more scholarly papers are required, usually fulfilled by the 2nd-year project report. The student must also pass a written examination, normally consisting of the written part of the Ph.D. qualifying examination with appropriately chosen passing requirements.

Candidates for the thesis option of the M.S. degree (less common) are required to complete 30 credits, including six of the nine principal Astronomy graduate courses (18 credits) and 6 credits of thesis research (ASTR 799). A written thesis is required and must be successfully defended in an oral examination. The student must also pass a written examination, normally consisting of the written part of the Ph.D. qualifying examination with appropriately chosen passing requirements.

Distinguished University Professor Emeritus
A'Hearn, Michael F.

Professor Emeritus
Earl, James A.
Harrington, J. Patrick
Leventhal, Marvin

Facilities and Special Resources

The Department has guaranteed observing time on the new 4.3-meter Discovery Channel Telescope through a partnership with Lowell Observatory. We have strong interactions with other major observatories, where many students and faculty maintain observing programs, and with neighboring scientific institutes, including the Naval Observatory, the Naval Research Lab, and other government agencies. We have joined with Caltech and other partners in the Zwicky Transient Facility, a time-domain survey for studying rare and exotic transient phenomena which will see first light at Palomar Observatory in 2017. Our planetary science team is heavily involved with space missions visiting solar system bodies, such as NASA's Deep Impact, EPOXI, and Rosetta missions to study comets.

The Center for Research and Exploration in Space Science & Technology (CRESST) is the most visible of our many interactions with NASA's Goddard Space Flight Center, located only 5 miles away. UMD researchers work together with Goddard scientists on many topics, ranging from the study of neutron stars, black holes, and extremely hot gas throughout the universe to the study of planets in our Solar System. This partnership offers an exciting array of opportunities for graduate students to work with Goddard scientists and facilities on their Ph.D. theses.

In 2010, U. Maryland and NASA's Goddard Space Flight Center signed an agreement launching the Joint Space-Science Institute (JSI), a close collaboration between the Departments of Astronomy and Physics and NASA/Goddard. JSI's areas of investigation include black hole physics, high-energy astrophysics, and cosmology.

The Department has also established a partnership with Pontificia Universidad Catolica de Chile (PUC). PUC, one of the top two institutions for astronomy in Chile, signed an agreement with UMD in 2010 that enables astronomy graduate students at both institutions to participate in a joint Ph.D. program starting in their third year. These students split their time between both locations and conduct their thesis research under the supervision of UMD and PUC co-advisors. UMD students gain improved access to Chilean observatories, which include many of the best telescopes in the world.

The Center for Theory and Computation (CTC), a strong group of theoretical astrophysicists within the department, built and maintains a Beowulf cluster to perform computational analyses and simulations across a range of research areas. We also have access to three larger university clusters, including the world-class 'DeepThought2' and 'MARCC/Bluecrab', which have been invaluable to our students in completing computationally-intensive thesis projects.

In 2014, much of the Department moved to the new Physical Sciences Complex (PSC). Highlights of the building include beautiful architecture, windowed office space for grad students, a grad student lounge, and a state-of-the-art visualization lab for state-of-the-art simulations and displays of large datasets.

This Department is associated with the following research units and facilities:

- Center for Research and Exploration in Space Science and Technology (CRESST): Partnership between UMCP, UMBC, USRA, and NASA/Goddard, with an emphasis on high-energy astrophysics.
- Joint Space Science Institute (JSI): Partnership between Astronomy, Physics, and NASA/Goddard, with an initial emphasis on high energy astrophysics, especially black holes. Established 2010.
- Laboratory for Millimeter Wave Astronomy (LMA)
- Center for Theory and Computation (CTC): Astronomy Dept. center for theory- and computation-related research programs.
- Discovery Channel Telescope (DCT)

- Zwicky Transient Facility (ZTF)

Financial Assistance

The Department of Astronomy offers both teaching and research assistantships. Essentially all full-time graduate students receive full financial support. Most students receive research assistantships to cover the summer period. These are either with faculty in the Department or with staff members at the NASA/Goddard Space Flight Center. Some summer teaching assistantships are also available.

Contact Information

For more specific information, contact:

Graduate Entrance Committee
Dept of Astronomy Univ of Maryland, College Park
MD 20742-2421
Telephone: (301)405-3001
Fax: (301)314-9067
astr-grad@deans.umd.edu

http://www.astro.umd.edu/

Courses: ASTR

Related Programs and Campus Units

Physics
Applied Mathematics & Statistics, and Scientific Computation

Atmospheric and Oceanic Science (AOSC)

Abstract

The Department of Atmospheric and Oceanic Science offers graduate study leading to the Master of Professional Studies, Master of Science, and Doctor of Philosophy degrees. Course work in atmospheric and oceanic sciences is also offered at the upper division and graduate level as a service to other campus graduate programs. The educational program is broadly based and involves many applications of the mathematical, physical and applied sciences that characterize modern atmospheric sciences and physical oceanography, including climate and earth system science, and multidisciplinary studies of the interrelationship among the atmosphere, the oceans, the land, and the biota. The Department's advanced degree programs are designed to prepare students for participation in contemporary research in the atmospheric and oceanic science. Research specializations include: atmospheric dynamics; atmospheric chemistry; physical oceanography; air pollution; atmospheric radiative transfer; remote sensing of the atmosphere, ocean, and land; climate variability and change; data assimilation; numerical weather prediction; severe storms; surface-atmosphere, ocean-atmosphere and biosphere-atmosphere interactions; and earth system modeling. The curriculum includes a set of Core courses to provide a fundamental background in atmospheric and oceanic dynamics, physical meteorology and atmospheric chemistry, earth system science and climate, as well as advanced specialized courses. Supervised research using state-of-the-art facilities then prepares the students for future contributions in their chosen field.

The Department's close association with federal agencies in the Washington area provides graduate students with good training and opportunities in atmospheric and

Faculty:

Chair
Carton, James A.

Director
Busalacchi, Antonio J.
Canty, Timothy

Distinguished University Professor
Kalnay, Eugenia E

Professor
Busalacchi, Antonio J.
Dickerson, Russell R.
Li, Zhanqing
Liang, Xin-Zhong
Murtugudde, Raghuram
Nigam, Sumant
Pinker, Rachel
Salawitch, Ross J.
Zeng, Ning
Zhang, Da-Lin

Assistant Professor
Ide, Kayo
Lampkin, Derrick

Senior Research Scientist
Grodsky, Semyon

oceanic science. As a research assistant, the student has the opportunity to develop a close working relationship with one or more of the scientific agencies.

Admissions Information

In addition to the requirements of the Graduate School, the department requires a Bachelors or higher degree in meteorology, oceanography, physics, chemistry, mathematics, biology, engineering or other program with suitable emphasis in the sciences. We welcome applications from those with no background in atmospheric sciences. The Core courses offered in the first year of study present students with the necessary background in atmospheric and oceanic science for the more advanced courses. The minimum undergraduate background includes 3 semesters of calculus, differential equations, linear algebra, 3 semesters of calculus-based physics, and 2 semesters of chemistry, one semester of computer programming. Scores from the GRE General Examination are also required.

The preferred application deadline for research assistantship consideration is January 15, and the final deadline is Feb 1.

International self funded applicants can submit applications until April 15, and Domestic self funded applications are due May 15.

Masters of Professional Studies (MPAO) applications are due May 15, for International applicants and June 15 for Domestic applicants.

Note: Applicants must get approval from the AOSC Department to apply to the Spring semester.

Application Deadlines

Fall:
Self funded domestic AOSC applicants and MPAO applicants must submit their application materials no later than June 1, for the following fall semester .
Self funded international students who are not competing for an assistanthip must submit their application materials no later than May 15, for the following fall semester .
All international and domestic applicants competing for a graduate research assistantship must submit their application materials no later than January 15, for the following fall semester for best consideration .
Spring:
MPAO applicants must submit their application materials not later than November 1, for the following Spring semester .
AOSC applicants will need special permission from the AOSC Department for Spring admission because of course sequence .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

PhD and MS Program

1. Application
2. Research Interests
3. GRE Scores
4. TOEFL/IELTS Scores (International Only)
5. Transcripts
6. 3 Letters of Recommendation
7. Resume (Optional)

Master of Professional Studies

1. Application
2. Official Transcripts
3. 2 Letters of Recommendation

Vinnikov, Konstantin
Zheng, Quanan

Associate Research Scientist
Allen, Dale
Ruiz-Barradas, Alfredo

Research Professor
Berbery, Ernesto H

Assistant Research Scientist
Canty, Timothy
Chepurin, Gennady

Research Professor Emeritus
Rasmusson, Eugene M.

Adjunct Professor
Higgins, Wayne
Kousky, Vernon
Lau, William
Pickering, Kenneth E.
Uccellini, Louis

University Affiliate
Kleist, Daryl
Lampkin, Derrick

Professor Emeritus
Hudson, Robert D.
Vernekar, Anandu D.

4. Statement of Purpose

Degree Requirements

Master of Science (M.S.)
The Atmospheric and Oceanic Science Department offers a non-thesis program leading to the Master of Science Degree. The requirements include course work, a scholarly paper and presentation, and a comprehensive examination. This program provides fundamental training to prepare students for research and operational work in the atmospheric and oceanic sciences.

Each new student will be assigned to a faculty advisor whose interests parallel those of the student. The faculty advisor will assist in the development of the student's course program and will follow the student's progress thereafter. The student may select an alternate advisor at any time, although financial support is dependent upon the availability of funds.

The student must submit an M.S. degree course plan and a tentative schedule for completion by the end of the first nine credit hours. A minimum of 30 semester hours of coursework is required for the degree program. This must include 24 hours of 600-level AOSC courses, including core courses listed below. The remaining 6 semester-hours can come from additional 600-level courses, 3 of these credits can come from AOSC 798 (MS Directed Graduate Research). The purpose of the scholarly paper is to demonstrate the ability to conduct original or literature research. The paper will become part of the permanent archive of the Department. A Ph.D. dissertation prospectus will satisfy this requirement.

The Comprehensive Examination for MS seeking students consists of a written examination. The written portion is composed of questions covering the subject areas of the following Core courses: AOSC 610, 620, and 617. Students will also be expected to complete AOSC611, AOSC621, and AOSC680 with a minimum grade of 3.0 (or to demonstrate mastery of this material). AOSC 611 can be replaced by AOSC 600 for those students with a specialization in Chemistry who get approval from their advisor, the AOSC Graduate Director, and Department Chair.

All requirements for the M.S. degree must be completed within a five-year period. This time limit applies to any transfer work from other institutions to be included in the student's program. A full-time student can easily complete the M.S. degree in two years.

Doctor of Philosophy (Ph.D.)
The Department of Atmospheric and Oceanic Science offers a program leading to the Doctor of Philosophy Degree (Ph.D.) in atmospheric and oceanic science. This program is designed to furnish the student with the background necessary to carry out independent and original scientific research. To earn the Ph.D., the student must complete a course work requirement, pass the Candidacy Examinations, and prepare and defend a dissertation.

A student seeking a Ph.D. degree will be assigned to a faculty advisor whose interests parallel those of the student. The academic advisor will establish and chair an advising committee which will oversee the student's degree program.

The course work requirement is 30 semester hours of 600-level or above AOSC Department courses. In addition, the student must take 12 credits of AOSC 899 (Doctoral Dissertation Research). Students may wish to take a number of the core courses in order to prepare for the Qualifying Examination. In addition, there is a Minor course requirement of six semester hours of ancillary courses taken beyond the bachelor's degree in a related scientific area at the 600-level or above. These credits must have a unified or coherent theme. Students may petition the Department for a waiver of a portion

of these requirements based on credits earned at another institution at the graduate level.

A student seeking the Ph.D. degree in atmospheric and oceanic science must pass the Candidacy Examinations, which are divided into two parts - The Qualifying Examination and the Specialty Examination. During the Specialty Examination, the student must present and defend a dissertation prospectus to the examination committee. Following successful defense, the student advances to candidacy. Ability to perform independent research must be demonstrated by a written dissertation. The dissertation should be an original contribution to knowledge and demonstrate the ability to present the subject matter in a scholarly style. Upon completion of the dissertation the candidate is required to present the research results at an Atmospheric and Oceanic Science Department seminar and to defend the material to the satisfaction of a Final Examining Committee appointed by the Dean for Graduate Studies.

Full-time students are expected to complete the Qualifying Examination by the end of the second year of graduate study and be admitted to candidacy by the end of the third year. Students must be admitted to candidacy within three years after admission to the doctoral program and at least six months before the date on which the degree will be conferred. The student must complete the entire program for the degree, including the dissertation and final examination, during a four-year period after admission to candidacy.

Graduate Track for Accomplished Scientists

Graduate students with exceptional scientific achievements may, through written petition to the Graduate Director, replace the written portion of the Comprehensive Exam with a seminar followed by an oral examination. To qualify for this track, the candidate needs to meet the following requirements:

1) have an earned MS degree in atmospheric or oceanic science, or a related field, ordinarily from an accredited American university, and receive approval from the five-member Departmental Examination Committee. 2) have published at least five, peer-reviewed, Science Citation Index (SCI) journal articles in atmospheric, oceanic, or a closely related science. He or she must be the lead or corresponding author of at least three of those papers.

The candidate must present an open seminar on his/her past research followed by a closed oral exam by the Examination Committee of at least three faculty plus the Graduate Director, and the Admissions Committee Chair. Two or more negative votes constitutes failure. The final decision will be subject to review by the committee of the whole.

Masters of Professional Studies (M.P.A.O.)
Master of Professional Studies (MPAO) The Master of Professional Studies in Atmospheric and Oceanic Science is designed for meteorologists, oceanographers and environmental scientists who need cutting-edge skills and knowledge in atmospheric and oceanic science, in the computational methods used in our field, and in air quality science. The Director of Professional Studies will advise students in planning his or her course of study, and will provide career advice and The degree is earned by successful completion of ten 3-credit courses. Students must complete two out of the following three Certificate programs, each of which consists of four courses, plus two courses from the remaining Certificate Program. Certificate #1, in Computational Methods in Atmospheric and Oceanic Science, develops computer skills needed to understand weather and climate analysis and prediction technologies. It is earned by successful completion of AOSC 630, AOSC 650, AOSC 684, and one of AOSC 614 or AOSC 615. Certificate #2, in General Atmospheric and Oceanic Science, provides a broad phenomenological understanding of weather and climate, and the dynamical, thermodynamical and radiative processes that drive them. It is earned by successful completion of AOSC 431, AOSC 617, AOSC632 and AOSC 670. Finally, Certificate #3, in Air Quality Science and Technology teaches the physical and chemical principles that govern air quality and allow for analysis and prediction of extreme weather. It is earned by successful completion of

AOSC 424, AOSC 600, AOSC 637, and either AOSC 624 or AOSC 625. The MPAO program is designed with the needs of working professionals in mind, and can be completed on a part-time basis over no more than 5 years, or on a full-time basis in 1 year and one semester.

Facilities and Special Resources

The Department participates in the Earth System Science Interdisciplinary Center (ESSIC) and the Cooperative Institute for Climate Studies (CICS). These institutions conduct research, and offer opportunities for graduate research beyond those offered by the department faculty. In addition, the Department maintains close research and teaching associations with Departments of Mathematics and Chemistry, as well as the Institute for Physical Science and Technology (IPST), Center for Scientific Computation and Mathematical Modeling (CSCAMM), and nearby government agencies including NOAA, NASA, ONR, USDA, NIST, and Marylands Department of the Environment and Department of Natural Resources.

Special facilities that support the Department's teaching and research activities include sophisticated computing facilities allowing access to a variety of atmospheric and oceanographic datasets, a laboratory for atmospheric chemistry, a mobile air pollution laboratory, access to research aircraft, a variety of supercomputers, radar, windprofiler at Fort Meade, historical data. Most importantly the students are encouraged to exploit the resources of the nearby government laboratories: NASA Goddard Space Flight Center, NOAA National Centers for Environmental Prediction.

The Department maintains a specialized library with several hundred text and reference books in meteorology and allied sciences, specialized series of research reports, and many journals. The campus provides a main library as well as specialized libraries in chemistry, astronomy, and engineering. Several excellent government libraries in the area, including the Library of Congress, the NASA Goddard Space Flight Center, the National Archives, and the NOAA libraries provide unsurpassed resources.

The University of Maryland is located in an area of unparalleled professional resources. Because of its proximity to the nation's capital, The University of Maryland is able to interact closely with the many governmental groups interested in various aspects of the atmospheric, oceanic and earth system sciences. Scientists from government laboratories participate in many aspects of graduate education, such as giving lectures in classes, presenting research results in seminars, and serving on dissertation committees. Likewise, the Department faculty often attend and participate in the seminars, colloquia and scientific workshops being held at these neighboring institutions.

The Washington, D.C. chapter of the American Meteorological Society consists of about 400 members who hold professional meetings each month. The Washington, D.C. area is frequently the site of national and international conferences, most notably of the American Association for the Advancement of Science and the American geophysical Union. In addition to the various government and academic institutions, the Washington metropolitan area contains numerous well-known private contractors and consulting companies involved in meteorology and oceanography, which provide employment opportunities for students both before and after graduation.

As a member of the University Corporation for Atmospheric Research, the department enjoys the common facilities offered by the National Center for Atmospheric Research such as research aircraft and supercomputers.

Financial Assistance

Graduate research and teaching assistantships are available to qualified graduate students. Research assistants carry out research in the areas of physical and dynamic meteorology, physical oceanography, data assimilation, remote sensing, atmospheric chemistry, air pollution, climate dynamics, atmospheric radiation, severe storms, global

climate change, and ocean-atmosphere and atmosphere-biosphere interactions. Fellowships are also awarded by the Graduate School to the most qualified applicants. In addition, hourly employment is available in the Department and off campus. Stipends are maintained at a competitive level.

Contact Information

Tamara Hendershot
3409 Computer and Space Science Building
College Park
MD 20742
Telephone: (301) 405-5389
Fax: (301)-314-9482
tammy@atmos.umd.edu

http://www.atmos.umd.edu/

Courses: AOSC

Related Programs and Campus Units

Applied Mathematics & Statistics, and Scientific Computation

Biochemistry (BCHM)

Abstract

The Graduate Program in Biochemistry offers study leading to Doctor of Philosophy and Master of Science degrees. Research specialization is available in protein structure, dynamics, and function; protein-protein and protein-nucleic acid interaction; protein and nucleic acid biochemistry; RNA and DNA structure, dynamics, interactions, and function; macromolecular folding and supramolecular assembly, post-translational protein modification and signaling, glycobiology, proteomics, mass spectrometry, biomolecular nuclear magnetic resonance spectroscopy, X-ray crystallography, enzyme mechanisms, drug metabolism, bio-organic chemistry, membrane structure and function, and metabolic regulation. Several of the biochemistry program faculty are members of the Institute for Bioscience and Biotechnology Research or other Related Programs and Campus Units listed below. Further information about the Biochemistry Graduate Program can be found athttp://www.chem.umd.edu/graduateprogram/phdinbiochemistry and http://www.chem.umd.edu.

Admissions Information

Admission to graduate study at the University of Maryland requires a minimum of a Bachelor of Science (B.S.), Bachelor of Arts (B.A.) or equivalent degree. Applications are normally accepted only from Ph.D.-seeking students. The area in which the undergraduate degree has been earned need not be chemistry or biochemistry, but previous coursework must normally include a minimum of 30 semester or 40 quarter hours of chemistry, with at least 1 year of general chemistry, 1 year of organic chemistry and 1 semester of biochemistry, as well as laboratory courses in organic chemistry and biochemistry. A course in physical chemistry and a laboratory course in analytical chemistry are also desirable. Typical overall grade point averages for successful applicants are 3.0 or greater (on a scale where the average grade is 2.0), and averages in science and math courses are generally higher than this. Three letters of reference indicating a potential for independent, creative scientific research are also required.

Faculty:

Chair
Reutt-Robey, Janice

Graduate Director
Julin, Douglas A.

Distinguished University Professor
Lorimer, George H.

Professor
Beckett, Dorothy
Fenselau, Catherine C.
Fushman, David
Herzberg, Osnat
Orban, John P.
Reutt-Robey, Janice
Wang, Lai-Xi

Associate Professor
Dayie, Kwaku
Julin, Douglas A.
Kahn, Jason D.

Assistant Professor
LaRonde-LeBlanc, Nicole
Paukstelis, Paul

University Affiliate
Reutt-Robey, Janice

Professor Emeritus
Hansen, J. Norman

The general Graduate Record Examination (GRE) scores are required of all applicants. Applicants from non-English speaking countries must also present the results of the Test of English as a Foreign Language (TOEFL) and the Test of Spoken English (TSE).

The above requirements represent minimum requirements and the competition for available space may limit admissions to persons with credentials above these minimum requirements.

Application Deadlines

Fall:
Applications must be received by February 1 (**January 1 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General required
2. GRE Subject recommended
3. 3 Letters of Recommendation (sent electronically)
4. TOEFL scores for international students
5. Transcripts (Originals must be sent to Enrollment Services Operations, Room 0130 Mitchell Building, University of Maryland, College Park, MD 20742)
6. "Statement of Goals & Research Interests" and "Statement of Experiences". (These can be submitted separately or as a single document.)

Degree Requirements

Master of Science (M.S.)

The M.S. degree program offers both the thesis and non-thesis options. Twenty-four course credits and six research credits are required for either option. The thesis option requires one seminar presentation and an oral defense of the thesis. Specific regulations are available from the Department of Chemistry and Biochemistry or on the internet at: www.chem.umd.edu.

Doctor of Philosophy (Ph.D.)

The requirements for the doctoral degree are: twenty-one course credit hours, twelve credits of research, two seminar presentations, an oral exam for advancement to candidacy, preparation and defense of an independent research proposal, and a final dissertation defense. Specific regulations are available from the Department of Chemistry and Biochemistry or on the internet at: www.chem.umd.edu.

Facilities and Special Resources

Biochemistry faculty and graduate students work in well-equipped, state-of-the-art research laboratories. Instrumentation and facilities that are available for research in biochemistry include analytical and preparative ultracentrifuges, high- and ultra-high field nuclear magnetic resonance spectrometers (600, 800, 900, 950 MHz), proteomic core facility, mass spectrometers, X-ray diffractometers, fluorescence/phosphorimagers, circular dichroism spectrometers, Sanger and next-generation DNA sequencing, microarray, quantitative PCR, electron microscopes, atomic force microscopes, confocal fluorescence microscopes, flow cytometer, animal colony, fermentation pilot plant, and a chemistry-biochemistry library.

Financial Assistance

Ph.D. candidates are normally supported on graduate teaching assistantships during their first year as graduate students. Teaching assistants usually instruct undergraduate

laboratory and recitation classes and receive in return a tuition waiver of ten credits each semester, salary, and health care benefits. Ph.D. candidates are normally supported in subsequent years on graduate research assistantships. Financial support is not generally available to M.S. candidates.

Contact Information

Information on requirements and research interests of the faculty may be obtained at www.chem.umd.edu.

Graduate Programs Office
0129 Chemistry Building,
University of Maryland, College Park,
MD 20742
Telephone: 301-405-7022 or 301-405-1028
Fax: 301-314-9121
chembchmadm@umd.edu

http://www.chem.umd.edu/

Courses: BCHM CHEM BISI BIPH CBMG CHPH BIOE

Related Programs and Campus Units

Biological Sciences
Biophysics
Chemistry
Chemical Physics
Biology
Cell Biology and Molecular Genetics
Engineering: Bioengineering
Institute for Advanced Computer Studies (UMIACS)
Institute for Bioscience & Biotechnology Research - IBBR at Shady Grove
Institute for Physical Sciences and Technology (IPST)
University of Maryland School of Medicine

Biological Sciences (BISI)

Abstract

The Biological Sciences (BISI) Graduate Program offers a wide range of training opportunities for students interested in pursuing doctoral level research in exciting, diverse areas across the biological sciences. BISI is an umbrella program comprised of four Concentration Areas:

Behavior, Ecology, Evolution, and Systematics (BEES)

Computational Biology, Bioinformatics, and Genomics (CBBG)

Molecular and Cell Biology (MOCB)

Physiological Systems (PSYS)

Please indicate your interest on the Application Supplemental Form or send questions via email to biologicalsciences@umd.edu.

Faculty:

Director
Thorne, Barbara

Distinguished University Professor
Colwell, Rita R.
Gantt, Elisabeth

Professor
Allewell, Norma M.
Andrews, Norma
Beckett, Dorothy
Borgia, Gerald
Carr, Catherine E.
Castonguay, Thomas W.
Chang, Caren
Cohen, Avis H.
Colombini, Marco
Cooke, Todd J.
Darden, Lindley
DeStefano, Jeffrey J.
Delwiche, Charles Francis
Dietz, James M.
Dinman, Jonathan D.
Dooling, Robert J.

Graduate students join a Concentration Area, but they may switch once on campus and may develop innovative research projects across traditional disciplinary boundaries. Descriptions of each Concentration Area, faculty research interests, and more detailed programmatic information are available at bisi.umd.edu.

Although the BISI Program is administered within the College of Computer, Mathematical, and Natural Sciences, it involves distinguished graduate faculty from many departments and several colleges at the University of Maryland as well as outstanding adjunct faculty from nearby research institutions. Students may have opportunities to work with participating scientists from - as examples - the National Institutes of Health; Smithsonian Institution Museum of Natural History, National Zoo, and Molecular Systematics Laboratory; the Food and Drug Administration; United States Department of Agriculture; and the Institute for Genomic Research. Thus, BISI students have an incomparable wealth of potential research options and collaborations that extend from Maryland's College Park campus throughout the Washington D.C. metropolitan area.

Admissions Information

All students applying to the Biological Sciences Graduate Program must have a Bachelor's degree from a recognized undergraduate institution. Applicants are expected to have a strong academic record, including coursework in advanced areas of biology as well as at least one year of calculus, general chemistry, organic chemistry, and physics. Able students with deficiencies in a particular area may be admitted and the deficiency corrected after enrollment. The Graduate Record Examination General Test is required; the Subject Test in Biology is recommended. **On the Application Supplemental Form (ASF) part of the online application, applicants should indicate one, or at most two, Concentration Areas of interest within BISI.**

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. University of Maryland application for graduate studies

2. Academic transcript(s)

3. Statement of purpose/research interests and professional objectives (can be reasonably broad; 1-2 pages in length)

4. 3 letters of recommendation from people familiar with the applicant's abilities and aptitude for graduate work

5. Scores of the Graduate Record Exam General Aptitude Test (institutional code is 5814; departmental code not required)

6. Scores of the Graduate Record Exam Advanced Biology Test (optional, but recommended)

7. International students must submit scores from the Test of English as a Foreign Language (TOEFL, internet based exam, iBT). Maryland's institutional code is 5814; no departmental code is needed.

Fagan, William F.
Fenselau, Catherine C.
Hutcheson, Steven W.
Inouye, David W.
Jeffery, William Richard
Kocher, Thomas D.
Ma, Michael
Mather, Ian H.
Mitter, Charles
Moss, Cynthia F.
Mosser, David M.
Ottinger, Mary A.
Palmer, Margaret
Payne, Richard
Popper, Arthur N.
Porter, Tom E.
Raupp, Michael
Reaka, Marjorie L.
Simon, Anne E.
Simon, Jonathan
St.Leger, Raymond
Stein, Daniel C.
Sukharev, Sergei I.
Sze, Heven
Via, Sara
Wilkinson, Gerald S.
Wolniak, Stephen M.

Associate Professor
Baldwin, Andrew H.
Cummings, Michael P.
Dudash, Michele R.
El-Sayed, Najib
Fenster, Charles B.
Haag, Eric S.
Hawthorne, David
Higgins, William J.
Julin, Douglas A.
Kahn, Jason D.
Lamp, William
Lee, Hey-Kyoung
Lips, Karen
Liu, Zhongchi
Machado, Carlos
McIver, Kevin
Mount, Stephen M.
Neel, Maile
Pick, Leslie
Quinlan, Elizabeth
Shrewsbury, Paula
Shultz, Jeffrey
Song, Wenxia
Stewart, Richard C.
Straney, David C.
Taneyhill, Lisa
Wang, Jian
Yager, David D.

Assistant Professor
Bely, Alexa
Briken, Volker
Butts, Daniel
Carleton, Karen
Fredericksen, Brenda
Gao, Lian-Yong
Gruner, Daniel
Hsieh, Adam
Kanold, Patrick
Kwak, June
Lee, Vincent
Pop, Mihai
Shah, Sameer
Soares, Daphne
Song, Jiuzhou

8. Applicants in BEES and PSYS are encouraged to contact BISI faculty with shared research interests. To explore matches of your interests with those of BISI faculty, see the BISI website, bisi.umd.edu.

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Ph.D. program in Biological Sciences is a research program providing opportunities for students to develop scholarly, innovative, and independent work. Courses are designed to strengthen and complement the student's research. An advisory committee helps guide each student in selecting classes and other learning experiences. Students are encouraged to present their research at national and international meetings and to publish in peer reviewed journals. Seminar series featuring prominent scientists expose students to exciting topics and help students develop collaborative contacts. During the course of their studies, each student must pass a qualifying exam, complete and defend an original dissertation, and present their thesis work in a seminar.

Facilities and Special Resources

The campus and local area provide students access to a vast array of instrumentation, equipment, facilities, and technologies to advance biological research. As examples, the college has state of the art facilities for research in all aspects of cell and molecular biology including cell and organism culturing, protein and nucleic acid analyses, peptide sequencing, oligonucleotide synthesis and sequencing, fluorescence, confocal microscopy, scanning and transmission electron microscopy, computer graphics for molecular modeling, NMR, mass-spectroscopy, and X-ray diffraction. Students have access to a laboratory for evolutionary molecular sequence analysis; gas source stable isotope mass spectrophotometer; bioacoustic lab; flume lab; GIS (graphic information systems) lab; and high-speed network access to a wide range of desktop and super-computing facilities. Greenhouses and animal care facilities are available.

We also have several state-of the-art shared instrumentation laboratories. Two center around biological imaging for both electron and light microscopy, including a field-emission scanner and an image reconstruction/deconvolution microscope. Another shared laboratory augments existing sequencing facilities on campus, enabling large-scale processing and sequencing of nucleic acids, with multiple robotic sequenators and real time PCR. Other core facilities provide instrumentation for fluorescence-activated cell sorting (FACS), NMR, mass spectrometry, and microarray technology. Equipment and analytical instruments are available in both faculty and core laboratories for the maintenance of animal and plant tissue cultures, for the production of monoclonal antibodies, for the synthesis and micro-analysis of proteins, for large-scale fermentation and cultivation of microorganisms, and for computer assisted molecular modeling. Support staffing in shared instrumentation facilities is provided by the college, and maintenance costs have been subsidized by the college, thereby providing even occasional users with appropriate training and access, and simultaneously keeping instrument use costs low. This strategy provides exceptional opportunities for research and training, and enables graduate students to perform experiments with instrumentation that is at the leading edge of biological technology.

Students have access to the Smithsonian National Museum and USDA collections of living and preserved organisms.

Library Facilities: The library facilities on campus, as well as their online accessibility, are outstanding. In addition, there are libraries in the local area with specialized collections. The most important are the National Agricultural Library, the Library of Congress, the National Library of Medicine, and the Smithsonian Institution Library. Thus, the University of Maryland's region contains perhaps the most comprehensive collections of books and journals in the world.

Adjunct Professor
Ballou, Jon
Battey, James
Braun, Michael
Breitburg, Denise L.
Collins, Allen
DiMichele, William A.
Edwards, James
Evans, Jay
Fleischer, Robert
Freed, Eric
Green, Kim
Hines, Anson H.
Holtz, Thomas R., Jr.
Hunt, Gene
Kelley, Matthew W.
Kelley, Matthew W.
Labandeira, Conrad
Lee, Chi-Hon
Leimgruber, Peter
Marino, John
Marra, Peter
McBride, Alison
Moss, Bernard
Moult, John
Owens, Robert
Parr, Cynthia
Platt, Christopher
Platt, Christopher
Potter, Michael
Pukazhenthi, Budhan
Rosenthal, Benjamin M.
Sauer, John R.
Stoltzfus, Arlin
Sues, Hans
Thompson, Katerina
White, Owen
Wickner, Reed
Wing, Scott
Zimmer, Elizabeth

Adjunct Assistant Professor
Hall, Neil

Affiliate Professor
Ades, Ibrahim Z.
Bentley, William E.
Bentley, William E.
Bryan, Philip N.
Chaverri, Priscila
Chernela, Janet
Culver, James N.
Darden, Lindley
Dooling, Robert J.
Dube, Shyam K.
Florea, Liliana
Gilson, Michael
Hamza, Iqbal
Herzberg, Osnat
Kelman, Zvi
Li, Shuwei
Mariuzza, Roy
Moss, Cynthia F.
Nelson, Daniel
Nuss, Donald
O'Brochta, David A.
Orban, John P.
Ottinger, Mary A.
Perez, Daniel
Song, Jiuzhou
Vakharia, Vikram
Wu, Louisa
Xiao, Shunyuan
Yager, David D.
Zhu, Xiaoping

Financial Assistance

Students are supported through fellowships, research assistantships, and/or teaching assistantships. Each type of funding provides a stipend, tuition remission, and access to health and dental insurance and a prescription drug plan. Historically, all students have been supported throughout their graduate careers.

Fellowships are offered on a competitive basis. Students who apply by the December 15 deadline are automatically considered for fellowships. There are no separate financial disclosure forms to fill out as part of the graduate application process.

Teaching assistantships require students to assist a faculty member in teaching a course or lab section(s). Benefits of teaching assistantships include building communication and organizational skills as well as resumé enhancement for academic, government, or private sector jobs. It is also delightfully rewarding to explain concepts to students and then witness their excitement as ideas "click" and their questions are resolved.

Contact Information

Students are strongly encouraged to communicate directly with faculty in the area of their interest. Additional general information may be obtained by emailing biologicalsciences@umd.edu or by calling the Biological Sciences Graduate Office at 301-405-6991.

Please visit the Biological Sciences Graduate Program website, featuring a search engine to match research interests with faculty and links to all Concentration Areas: bisi.umd.edu

International students with questions about the application process should visit the University of Maryland's Office of International Services website at http://www.international.umd.edu/ies/97 or email iesadv@deans.umd.edu

Ms. Gwen Warman
2101 Bioscience Research Building
University of Maryland College Park
MD 20740
Telephone: 301-405-6905
Fax: 301-314-9921
biologicalsciences@umd.edu

Courses: BEES BISI CBMG BIOL MOCB BIOM BSCI ENTM

Related Programs and Campus Units

Biochemistry
Biophysics
Chemistry
Entomology
Marine-Estuarine-Environmental Sciences
Neuroscience and Cognitive Science
Veterinary Medical Sciences
Sustainable Development and Conservation Biology
Applied Mathematics & Statistics, and Scientific Computation

Affiliate Associate Professor
Muro, Silvia

Affiliate Assistant Professor
Lei. Elissa

Professor Emeritus
Dively, Galen II
Gill, Douglas E.
Highton, Richard
Weiner, Ronald M.

Biophysics (BIPH)

Faculty:

Abstract

The Biophysics Program in the Institute for Physical Science and Technology offers Ph.D. degrees in Biophysics. It is affiliated with the College of Computer, Mathematical and Natural Sciences, and the College of Engineering. Doctoral degrees are offered.

The Maryland Biophysics Program aims to train graduate students in the use of theoretical, computational, and experimental methods to gain quantitative insights into biological systems. The post genomic era is bringing tools for unprecedented characterization and control of living systems. To fully harness these tools for quantitative insights in biology, biomedicine, and bioengineering requires expertise from a number of disciplines. Thus our program includes faculty from Chemistry, Physics, Biology, Materials Science and Bioengineering. The Biophysics Program is open to students with undergraduate degrees in chemistry, physics or biology as well as students with majors in mathematics, computational science or engineering. Because student backgrounds are diverse, we tailor the curriculum to suit the needs of the individual. The online application is located at apra@umd.edu.

Research areas include Membranes and channels, Theory of molecular machines and motors, Cell mechanics, Motility and the cytoskeleton, Theoretical studies of protein and RNA folding and aggregation, Single molecule biophysics, Theory of hydrophobic and electrostatic interactions Scattering Techniques in RNA and Polymers Protein Structure, Nonlinear dynamics and biophysics of biological regulation, Mechanisms of allostery and protein assembly. The core courses that include but are not limited to Statistical Mechanics, Chemical Thermodynamics, Biophysical Chemistry, Membrane Biophysics and Cell Biology, constitute the basis for further specialization.

Admissions Information

Students dedicated to a career in experimental or theoretical biophysics are sought. General GREs are required and a Subject GRE (Biology, Chemistry, Biochemistry or Physics) is also required but may be waived under certain circumstances. For international individuals acceptable TOEFL scores are required. A resume or curriculum vitae and official transcripts are required. A personal statement of 500-1000 words which covers (1) life experiences and research, and (2) goals for research in biophysics is an integral part of the admissions process. Prior research experience is highly desirable. Three or more letters of recommendation must be included. The electronic admission process is through the link:
https://app.applyyourself.com/AYApplicantLogin/fl_ApplicantConnectLogin.asp?id=umdgrad

Application Deadlines

Fall:
The deadline for Fall admission is January 15. There is NO Spring admission .

Application Requirements

See Admissions Information above

Degree Requirements

Doctor of Philosophy (Ph.D.)

One course, Research in Biophysics, which consists of three seven week rotations through three experimental or theoretical research groups, is required of all students. A short presentation must be made to all students at the end of each rotation. Students must meet and report their progress to a three-person mentoring committee starting with the first semester. A qualifier exam must be passed. Admission to candidacy is granted after the successful presentation of a research proposal to the Program Director and the three-member committee. A dissertation must be written and defended before a committee.

Dean
Jayanth Banavar

Director
Sukharev, Sergei I.

Associate Director
Fushman, David

Distinguished University Professor
Lorimer, George H.
Thirumalai, Devarajan
Weeks, John D.

Professor
Beckett, Dorothy
Briber, Robert M.
Colombini, Marco
Levy, Doron
Losert, Wolfgang

Associate Professor
Aranda-Espinoza, Jose Helim
Girvan, Michelle
Kanold, Patrick
Papoian, Garegin

Assistant Professor
Matysiak, Silvina
Seog, Joonil
Upadhyaya, Arpita

Affiliate Associate Professor
Klauda, Jeffery

Facilities and Special Resources

Eleven of the eighteen faculty run experimental laboratories. Multiple experiments are conducted at the same time with graduate students working on the experiments. A Biophysics Seminar is run on the average of once a week, generally given by visiting scholars. For those students electing to take the Seminar for credit, one credit is offered, and these students must sign in each week. Faculty form three-person committees to mentor students, as mentioned above. Symposia consisting of about six nationally and internationally known scholars are conducted once a semester on various topics. These are well attended by students, postdocs, faculty and visitors from local institutions such as NIH and Johns Hopkins.

Financial Assistance

TAships, RAships, Fellowships, arrangements for support from the National Institutes of Health.

Contact Information

www.marylandbiophysics.umd.edu

Star Jackson, Program Coordinator
Biophysics Program, 2112 IPST Bldg 085 Institute for Physical Science and Technology
University of Maryland College Park
MD 20742
Telephone: (301)405-9307
Fax: (301)314-9404
starj@umd.edu

http://www.marylandbiophysics.umd.edu/

Professor Sergei Sukharev, Interim Director, Biophysics Program
3216 Biology-Psychology Building
University of Maryland College Park
MD 20742
Telephone: (301)405-6923
Fax: (301)314-9404
sukharev@umd.edu

http://www.marylandbiophysics.umd.edu/

Courses: CHEM BCHM BIOL BSCI BIOE PHYS ENMA BIPH

Related Programs and Campus Units

Chemical Physics
Chemistry
Engineering: Materials Science and Engineering
Physics
Biological Sciences
Biochemistry

Business and Management (BMGT)

Faculty:

Dean
Triantis, Alexander J.

Abstract

The Robert H. Smith School of Business offers graduate programs leading to the degrees of Master of Business Administration (MBA), Master of Finance, Master of

Science in Accounting(MS), Master of Science in Information Systems (MS), Master of Science in Marketing Analytics (MS), Master of Science in Supply Chain Management (MS), Executive MBA (EMBA), Online MBA, and Doctor of Philosophy (PhD). The school's MBA program is accredited nationally by the Association to Advance Collegiate Schools of Business (AACSB International). Only about 607 programs in the world are accredited by the AACSB, a reflection of the quality of the faculty, students, curriculum, and career management.

The Smith School of Business faculty has been recruited from the graduate programs of leading universities nationwide. They are dedicated scholars, teachers, and researchers with a strong commitment to academic excellence and the education of the professional manager and researcher. The Smith School of Business is dedicated to preparing graduates to lead organizations in an economy driven by technology, globalization, and rapid change. The Smith School curriculum integrates an in-depth education in core business functions -- accounting, entrepreneurship, finance, information technology, logistics, management, and marketing -- with cross-functional e-business areas -- electronic commerce, financial engineering, services marketing, and supply chain management.

Admissions Information

We strongly encourage you to visit the Robert H. Smith School of Business website at www.rhsmith.umd.edu. The Smith School website contains a wealth of information regarding all graduate business programs and their admissions processes.

MBA and MS Admissions Office: 301-405-2559
Executive MBA Admissions Office: 301-405-2386
Online MBA Admissions Information: 877-807-8741
PhD Admissions Office: 301-405-2214

Admission criteria for the MBA program are based on: quality of undergraduate and graduate coursework; score on the GMAT or GRE; 1 letter of recommendation; professional experience; and written essay of objectives. Prospective applicants may contact the program at (301) 405-2559 for information regarding the MBA program.

Admission criteria for the Online MBA program are based on: quality of undergraduate and graduate coursework; score on the GMAT or GRE; 1 letter of recommendation; professional experience; and written essay of objectives. Prospective applicants may contact the program at 877-807-8741 for information regarding the online MBA program.

Admission criteria for the EMBA program are based on: quality of undergraduate and graduate coursework; 1 letter of recommendation; professional experience; and written essays of objectives. Prospective applicants may contact the program at (301) 405-2386 for information regarding the EMBA program.

Admission criteria for the MS program focusing in accounting are based on: quality of undergraduate and graduate coursework; , 1 letter of recommendation; professional experience; video submission; and written essay of objectives. Prospective applicants may contact the program at (301) 405-2559 for information regarding the MS program.

Admission criteria for the Master of Finance are based on: quality of undergraduate and graduate coursework; GMAT or GRE score, 1 letter of recommendation; professional experience; video submission; and written essay of objectives. Prospective applicants may contact the program at (301) 405-2559 for information regarding this Masters program.

Admission criteria for the MS program focusing in information systems are based on: quality of undergraduate and graduate coursework; GMAT or GRE score, 1 letter of recommendation; professional experience; video submission; and written essay of

Associate Dean
Ball, Michael O.
Russell, Joyce E.A.

Area Chair
Chen, Gilad
Chen, Zhi-Long
Dresner, Martin E.
Kannan, Pallassana K.
Loeb, Martin P.
Maksimovic, Vojislav

Professor
Agarwal, Ritu
Anandalingam, Gnanalingam
Bakshi, Gurdip S.
Ball, Michael O.
Bartol, Kathryn M.
Corsi, Thomas M.
Dresner, Martin E.
Frank, Howard
Fu, Michael C.
Golden, Bruce L.
Gordon, Lawrence A.
Grimm, Curtis M.
Gupta, Anil K.
Kim, Oliver
Leete, Burt A.
Loeb, Martin P.
Loeb, Stephen E.
Lucas, Henry C., Jr.
Madan, Dilip B.
Morici, Peter G.
Raghavan, Subramanian
Raschid, Louiqa
Ratchford, Brian
Riley, Donald R.
Rust, Roland T.
Senbet, Lemma W.
Shapiro, Debra L.
Sims, Henry P., Jr.
Smith, Kenneth G.
Taylor, M. Susan
Triantis, Alexander J.
Unal, Haluk
Windle, Robert J.

Associate Professor
Alt, Francis B.
Baum, J. Robert
Biehal, Gabriel J.
Elmaghraby, Wedad
Evers, Philip T.
Faraj, Samer
Kannan, Pallassana K.
Krapfel, Robert E., Jr.
Phillips, Gordon M.
Prabhala, Nagpurnanand
Reger, Rhonda K.
Rindova, Violina
Stevens, Cynthia K.
Wagner, Janet
Wermers, Russell R.

Assistant Professor
Avramov, Doron
Chen, Mark
Chung, Wilbur C.
Darcy, David P.
Dellarocas, Chrysanthos
Druehl, Cheryl
Feinberg, Susan E.
Foutz, Ying Natasha
Gillyard, Angelisa
Goldfarb, Brent
Gopal, Anandasivan

objectives. Prospective applicants may contact the program at (301) 405-2559 for information regarding the MS program.

Admission criteria for the MS program focusing in supply chain management are based on: quality of undergraduate and graduate coursework; GMAT or GRE score which is optional if applicants have a quantitative background; 1 letter of recommendation; professional experience; video submission; and written essay of objectives. Prospective applicants may contact the program at (301) 405-2559 for information regarding the MS program.

Admission criteria for the MS program focusing in marketing analytics are based on: quality of undergraduate and graduate coursework; GMAT or GRE score, 1 letter of recommendation; professional experience; video submission; and written essay of objectives. Prospective applicants may contact the program at (301) 405-2559 for information regarding this MS program.

Application Deadlines

Fall:
Applications for the part-time MBA program should be received by June 1 (**April 15 preferred**) .
Applications for the MS program should be received by May 1 (**May 1 preferred**) .
Applications for Ph.D. program must be received by December 15 (**December 15 preferred**) .
Applications for the full-time MBA program should be received by May 1 (**January 15 preferred**) .
Spring:
Applications for the EMBA program should be received by November 30 (**July 15 preferred**) .
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

MBA Program

- GMAT or GRE
- 1 letter of recommendation
- Essay
- Undergraduate/Graduate transcripts
- Resume
- TOEFL (for international applicants)

Online MBA Program

- GMAT or GRE
- 1 letter of recommendation
- Essay
- Undergraduate/Graduate transcripts
- Resume
- TOEFL (for international applicants)

MS Programs and Master of Finance Program

- GMAT or GRE (optional for MS in accounting applicants. Also optional for MS in supply chain management if applicants have a quantitative background)

Gosain, Sanjay
Hamilton, Rebecca Warme
Heston, Steven L.
Hoberg, Gerard
Hutchens, Walter C.
Hvidkjaer, Soeren
Jain, Sanjay
Jank, Wolfgang
Karaesmen, Itir Z.
Kirsch, David
Loewenstein, Mark V.
Marquez, Robert S.
Mishra, Abhay N.
Moe, Wendy
Sampson, Rachelle
Seo, Myeong-Gu
Shmueli, Galit
Somaya, Deepak
Souza, Gilvan
Srivastava, Joydeep
Stewart, Katherine
Turner, Scott F.
Viswanath, Sivakumar
Waguespack, David M.
Willard, Gregory
Zantek, Paul F.

Research Associate Professor
Bailey, Joseph P.

Research Professor
Boyson, Sandor L.

Lecturer
Bingham, Christopher B.
Boyd, Henry C.
Bulmash, Gary F.
Cichello, Michael S.
DeWitt, William J.
Ferraro, Rosellina
Finch, Michael L.
Gao, Guodong
Goyal, Manu
Ibrahim, Hassan
Kiss, Elinda F.
Kudisch, Jeffrey
Lefkoff-Hagius, Roxanne
Lele, Shreevardhan
Mithas, Sunil Kumar
Olson, Charles E.
Park, Taewoo
Peters, James M
Russell, Joyce E.A.
Rymer, Vicki S.
Shaffer, Brian C.
Studer-Ellis, Erich M.
Suarez, Jose G.
Turner, Hugh
White, Susan
Whitney, Diane

University Affiliate
Chen, Gilad

Professor Emeritus
Bodin, Lawrence D.
Carroll, Stephen J., Jr.
Gannon, Martin J.
Gass, Saul I.
Greer, Thomas V.
Haslem, John A.
Kolodny, Richard
Lamone, Rudolph P.

- 1 letter of recommendation
- Essay
- Undergraduate/Graduate transcripts
- Resume
- Video submission
- TOEFL (for international applicants)

Executive MBA Program

- 1 letter of recommendation
- Essays
- Undergraduate/Graduate transcripts
- Resume
- TOEFL (for international applicants)

Degree Requirements

Master of Business Administration/Master of Science (M.B.A/M.S.)

The Robert H. Smith School of Business is a global leader in integrating business management and technology. Smith MBAs can take advantage of this strength in the joint MBA/MS degree program and leverage their managerial skills with studies that develop research and technological skills in finance, accounting, information systems, or supply chain management. Students may apply for admission to the MBA/MS degree program at the beginning of the application process or at the end of their first year in the MBA program. Students must complete all required courses for both programs and reach a total of 66 credits.

Master of Business Administration/Master of Science in Nursing (MBA/MSN)
Students are eligible to pursue a joint degree through the Robert H. Smith School of Business and the University of Maryland School of Nursing, located in Baltimore, Maryland. Information about the Nursing Program can be found at http://nursing.umaryland.edu/

Online Master of Business Administration (MBA)
Select an MBA specialization in Finance, Information Systems and Business Analytics, Accounting or Marketing, or choose the general track that introduces you to the core concepts of each specialization. Earn your MBA online in as few as 21 months while remaining active in your current career. Engage in education online through a flexible, user-friendly learning environment recognized as one of the best in the marketplace.

MBA/MPP Joint Program Degree (MBA/MPP)

The Robert H. Smith School of Business and the School of Public Policy offer a joint program of studies leading to the MBA and MPP degrees. Under the terms of the joint program, a student may earn both degrees in approximately five semesters. The accelerated program is possible because some courses can be credited toward both degrees. Candidates must be admitted to both programs. Information about the MPP degree can be found at http://www.publicpolicy.umd.edu

Under the joint program, 66 credits are required for graduation, split about equally between the programs. Grade point averages in each program will be computed separately and students must maintain minimum standards in each school to continue in the program. A student must complete both programs satisfactorily in order to receive both degrees. A student whose enrollment in either program is terminated may elect to

Locke, Edwin A.
Preston, Lee E.

Associate Professor Emeritus
Nickels, William G.

complete work for the degree in which he or she remains enrolled, but such completion must be upon the same conditions as required of regular (nonjoint program) degree candidates. Student programs must be approved by the Associate Dean of the School of Public Policy and the Associate Dean for Masters Programs. For further discussion of admission and degree requirements, students should see the general admission requirements for each program.

Master of Business Administration (M.B.A.)

The Robert H. Smith School of Business offers an MBA program designed to provide the educational foundation for those students with the potential to exhibit the highest degree of excellence in future careers as professional managers. The MBA program requires 54 credits of coursework, which is normally four semesters for a full-time student. There is no thesis requirement. Successful students in the program are expected to demonstrate the following: (1) a thorough and integrated knowledge of the basic tools, concepts, and theories relating to professional management; (2) behavioral and analytical skills necessary to deal creatively and effectively with organizations and management problems; (3) an understanding of the economic, political, technological, and social environments in which organizations operate; (4) a sense of professional and personal integrity and social responsibility in the conduct of managerial affairs both internal and external to the organization.

Students whose cumulative grade point average falls below 3.0 will be placed on probation and will be given a specified amount of time to raise the average to a 3.0. Failure to do so will result in academic dismissal from the program.

Maryland MBA graduates obtain employment in a wide spectrum of organizations at highly competitive starting salaries.

MBA/JD Joint Program Degree (MBA/JD)

The Robert H. Smith School of Business and the University of Maryland School of Law in Baltimore offer a joint program of studies leading to MBA and JD degrees. Under the terms of the joint program, a student may earn both degrees in four academic years. The accelerated program is possible because some courses can be credited toward both degrees. Candidates must apply for admission to the Law School as well as to the MBA program at College Park and must be admitted to both programs. Information about the JD program can be found at http://www.law.umaryland.edu/index.html

Twenty-one credits of law will be substituted for MBA elective coursework. Grade point averages in each program will be computed separately and students must maintain minimum standards in each school to continue in the program. The Graduate School will not accept transfer credit from coursework taken outside the joint program. A student must complete both programs satisfactorily in order to receive both degrees. The MBA and the JD degrees must be awarded simultaneously. A student whose enrollment is terminated in one program may elect to complete work for the degree in which he or she remains enrolled, but such completion must be upon the same conditions as required of regular (nonjoint program) degree candidates. Student programs must be approved by the law school adviser for the joint program and the Associate Dean for Masters Programs. For further discussion of admission and degree requirements, students should see the above and consult the entry in the University of Maryland School of Law catalog.

Executive Master of Business Administration (MBA)
The EMBA program is designed for mid-career professionals to high-level executives who desire a systemic approach to managing and leading corporate functions. Admission to the EMBA program is highly competitive and is based on significant and relevant professional and managerial work experience, prior academic performance, and personal attributes. The Robert H. Smith School of Business seeks to attract an internationally and professionally rich student population, diverse across industry and functional expertise.

Master of Finance (MFin)
The Master of Finance program provides students with the knowledge and skills necessary to succeed in the complex and networked world of finance.

Master of Business Administration/Master of Social Work (M.B.A./M.S.W.)
This program provides a unique combination of skills for those who wish to become managers of social service agencies. Elective courses can be taken at either the School of Social Work, University of Maryland, Baltimore, or at the Robert H. Smith School of Business. This program requires 90 total credit hours for graduation and can be completed in three years. More information on the School of Social Work can be found at http://www.ssw.umaryland.edu

Master of Science in Accounting (M.S.)
Participants in the Master of Science in Accounting program gain the leading-edge knowledge and skills they need to bring exceptional value to their firms in today's high-stakes accounting arena - and earn an advanced accounting degree from one of the world's leading business schools. The curriculum is relevant, practical and applicable from day one, focusing on such key issues as: internal audit application and practice, current trends in corporate governance, the role of managerial accounting in overall management planning and control structure, fraud prevention, deterrence, detection, and control, and IT security, IT controls and IT auditing.

Master of Science in Marketing Analytics (MS)
The MS in Marketing Analytics will give you the cutting-edge knowledge and skills you need to apply marketing analytics to daily business practice. The program will provide you with an in-depth understanding of the mathematical and statistical models and tools needed for customer analysis in the context of marketing problems.

Master of Science in Supply Chain Management (MS)
The MS in Supply Chain Management program will prepare you to discover emerging opportunities and lead innovation on a global scale. Whether you're a recent graduate with an interest in how goods move around the world or a manager who would like to broaden your understanding of the global supply chain, our curriculum will prepare you for new and growing career options in this dynamic industry.

Master of Science in Information Systems (MS)
The MS in Information Systems program is ideal for those who understand the value of technology and are interested in gaining the knowledge to manage it. You will learn how information is captured, organized, managed and analyzed, preparing you to lead in the ongoing technology revolution. Get ready to harness the power of information and help move your organization to the next level.

Facilities and Special Resources

The Office of Career Services (OCS) provides dedicated, professional support to help students launch their careers. The center links students directly to recruiters through a variety of services, including on- and off-campus recruitment and the online resume database, which matches a Smith MBA to the right industry position. The OCS also participates in regional and national career forums and job fairs, such as the National MBA Consortium, the National Black MBA Conference, the National Hispanic MBA Conference, the National Association of Women MBA's Conference, and the Career Services Council.

The Smith School is located in the Baltimore/Washington, D.C./Northern Virginia corridor. This region offers one of the highest concentrations of culture, diversity, and career opportunities in the country.

Financial Assistance

Financial aid is available to qualified full-time and Executive MBA students in the form of fellowships, graduate assistantships, and scholarships.

Contact Information

The Smith School of Business has available brochures that give specific degree requirements for the MBA, EMBA, and MS Programs. Program information is available online at http://www.rhsmith.umd.edu. Initial inquiries should be directed to:

MBA/MS Admissions
2303 Van Munching Hall, College Park,
MD 20742
Telephone: 301-405-2559
Fax: 301-314-9862
For MBA inquiries, please contact mba_info@rhsmith.umd.edu. For MS inquiries, please contact ms_info@rhsmith.umd.edu For online MBA inquiries, please visit www.onlinemba.umd.edu

http://www.rhsmith.umd.edu

Courses: BMGT BUFN BUAC BUDT BULM BUMK BUMO BUSI

Related Programs and Campus Units

Engineering: Systems Engineering
Real Estate Development

Business and Management:Doctoral Programs (BPHD)

Faculty:

Abstract

The Robert H. Smith School of Business offers graduate programs leading to the degrees of Master of Business Administration (M.B.A.), Masters of Science in Business (M.S.) and Doctor of Philosophy (Ph.D.). The school's M.B.A. program is accredited nationally by the Association to Advance Collegiate Schools of Business (AACSB International). Only about 607 programs in the world are accredited by the AACSB, a reflection of the quality of the faculty, students, curriculum, and career management. The Smith School of Business faculty has been recruited from the graduate programs of leading universities nationwide. They are dedicated scholars, teachers, and researchers with a strong commitment to academic excellence and the education of the professional manager and researcher. The Smith School of Business is dedicated to preparing graduates to lead organizations in an economy driven by technology, globalization, and rapid change. The Smith School curriculum integrates an in-depth education in core business functions -- accounting, entrepreneurship, finance, information technology, logistics, management, and marketing -- with cross-functional e-business areas -- electronic commerce, financial engineering, services marketing, and supply chain management.

Admissions Information

Admission criteria for the Ph.D. program are based on: (1) quality of undergraduate and graduate coursework; (2) score on the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE); (3) letters of recommendation; (4) other relevant information and professional experience; and (5) a written essay of objectives/statement of goals. Prospective applicants may call (301) 405-2214 for information regarding the Ph.D. program.

Application Deadlines

Application Requirements

PhD Program:

- GMAT or GRE
- 3 letters of recommendation
- Official Undergraduate/Graduate transcripts
- Written essay of Objectives/Statement of Goals
- TOEFL (for international applicants)

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Ph.D. program is a full-time program designed to produce outstanding scholars in management-related disciplines. Thus, a strong research philosophy pervades the entire program. The low student-to-faculty ratio fosters a high degree of interaction between faculty and students on research projects of mutual interest, frequently culminating in journal articles. Students whose career aspirations are congruent with the program's research orientation can look forward to a learning experience that is not only demanding but also stimulating and enriching. Graduates of the program have accepted positions at various academic institutions including: Boston College, College of William and Mary, Cornell University, Columbia University, Georgetown University, Georgia Institute of Technology, Hong Kong University of Science and Technology, Indiana University, Instituto de Empresa (Madrid), Lehigh University, McGill University, National Taiwan University, National University of Singapore, Notre Dame, Penn State University, Rensselaer Polytechnic Institute, Southern Methodist University, Syracuse University, Texas A & M University, University of Houston, University of California (Davis), University of California (Los Angeles), University of Southern California, University of Texas, University of Washington, University of Wisconsin, and Vanderbilt University. All Ph.D. students are provisionally admitted and must achieve at least a 3.25 GPA in each of their first two semesters. Failure to do so results in being placed on probation for one semester. The student will then be dismissed unless a 3.25 overall GPA is obtained. Ph.D. course requirements depend on the amount of relevant prior study. Preparation in calculus is required for admission. The Ph.D. student may select a single major (18 credits), one minor (12 credits), and a set of research tools courses (12 credits). Every Ph.D. student must register for a minimum of 12 dissertation research credits during the program. Major areas of research may be chosen from among such fields as accounting and information assurance, finance, organizational behavior/human resource management, strategic management, information systems, operations management/management science, marketing, and supply chain management. Minors and second majors may include areas inside or outside the Smith School of Business. Typical outside minors include economics, engineering, mathematics, psychology, and sociology. Students are required to take a written comprehensive examination in their major area. Additional exam(s) may be required. Upon successful completion of all departmental requirements, including (though not limited to) coursework and comprehensive exam(s), the student is advanced to candidacy. Each Ph.D. candidate prepares a formal dissertation proposal and presents it at an open meeting of faculty and students. The proposal should clearly indicate how the dissertation will make a contribution to the literature of the field. Ultimately, each Ph.D. candidate is required to prepare and formally defend the completed dissertation at an open meeting of faculty and students before officially graduating from the Ph.D. Program.

Facilities and Special Resources

The Robert H. Smith School of Business offers a PhD Program Suite, where every student has access to office space and supplies. Students have access to software and research computing tools.

Financial Assistance

Financial support is available to doctoral students in the form of fellowships, graduate assistantships, and scholarships.

Contact Information

More information is available at our website www.rhsmith.umd.edu/doctoral.

The Robert H. Smith School of Business PhD Program Office
Robert H. Smith School of Business - Doctoral Programs 3330 Van Munching Hall
University of Maryland
MD 20740
Telephone: (301)405-2214
Fax: (301)314-9611
businessphd@rhsmith.umd.edu

http://www.rhsmith.umd.edu/doctoral

Courses: BMGT

Related Programs and Campus Units

Applied Mathematics & Statistics, and Scientific Computation

Chemical Physics (CHPH)

Abstract

The Chemical Physics Program is a program of study and research leading to Master of Science and Doctor of Philosophy degrees for students who wish to enter professional careers requiring an in-depth knowledge of both physics and chemistry. Students can choose research topics across many disciplines including biophysics, chemistry, physics, chemical engineering, electrical engineering, materials and nuclear engineering, mechanical engineering and meteorology.

The Chemical Physics Program is designed for students with undergraduate degrees in physics, chemistry, or engineering who are sufficiently well prepared in mathematics and the physical sciences to undertake graduate training in physics and physical chemistry. Formal course offerings in quantum mechanics,quantum chemistry, spectroscopy, thermodynamics, electricity and magnetism, statistical mechanics and biophysics prepare a student to explore the broad range of research topics at the University of Maryland. Research areas of the Chemical Physics faculty include: the study of single molecules as well as gases, surfaces, solids and polymers by means of laser-light, electron scattering, and nanomicroscopies; the study of dynamic phenomena from atom-molecule collisions to protein-folding and hydrodynamics; thermodynamics from phase transitions and critical phenomena to combustion; the statistical mechanical theory of phase transitions, fluid dynamics and non-equilibrium phenomena; the quantum mechanical theory of molecules and molecular dynamics; atmospheric physics and chemistry; and biophysics.

The Chemical Physics Program is sponsored by the Institute for Physical Science and Technology and seven academic departments: Chemistry and Biochemistry, Physics, Electrical and Computer Engineering, Chemical Engineering, Materials and Nuclear Engineering, Mechanical Engineering, and Meteorology. Formal arrangements with the

Faculty:

Director
Papoian, Garegin

Distinguished University Professor
Alexander, Millard H.
Gupta, Ashwani K.
Ott, Edward
Phillips, William D.
Weeks, John D.
Williams, Ellen D.

Professor
Al-Sheikhly, Mohamad I.
Anisimov, Mikhail A.
Briber, Robert M.
Carton, James A.
Dagenais, Mario
Davis, Christopher C.
Dickerson, Russell R.
Ehrman, Sheryl H.
Eichhorn, Bryan W.
Falvey, Daniel E.
Fourkas, John T.
Fushman, David
Hill, Wendell T., III
Jarzynski, Christopher
Kirkpatrick, Theodore R.
Kofinas, Peter
Lathrop, Daniel P.
Lee, Sang Bok
Losert, Wolfgang
Mignerey, Alice C.

National Institute of Standards and Technology (NIST) and the National Institute of Health (NIH) allow students to perform research off campus under the supervision of a government scientist associated with the program and a Chemical Physics faculty member. The Chemical Physics Committee oversees the program and is made up of representatives from the sponsoring units with the Program Director as chair. The Chemical Physics Program Office administers the program and is affiliated with the Institute for Physical Science and Technology. A booklet describing Chemical Physics at Maryland, College Park, can be obtained from the Chemical Physics office upon request.

Admissions Information

The program is for students with undergraduate degrees in chemistry, physics or engineering. For those students with degrees in other disciplines, knowledge of calculus, differential equations, and vector algebra, as well as introductory mechanics, electricity and magnetism, and quantum mechanics is ordinarily expected.

Application Deadlines

Fall:
Applications must be received by February 1 (**February 1 preferred**) .
Spring:
Applications must be received by June 1 (**June 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. GRE Subject (in Chemistry, Mathematics, or Physics)
3. Transcripts from all attended schools
4. Three Letters of Recommendation
5. TOEFL, which includes the Test of Written English (TWE) required for international applicants

Degree Requirements

Master of Science (M.S.)

Admission to the program is limited to Ph.D. students. Students can earn a thesis or a non-thesis M.S. degree while working towards the Ph.D. degree. In order to earn a non-thesis M.S. degree in Chemical Physics, students must pass the written Qualifying Examination at the M.S. level, maintain a B average, 30 graduate credits of which 24 must be course credits including: 1.Two seven week rotations 2.Advanced laboratory course 3.Scholarly paper 4.Two credits of seminar, can be included in the non-course credits 5.Advanced course at the 600 level or above Rotations are seven weeks each, with student presentations about two weeks after the end of each rotation period. Students will be evaluated in part based on their presentations. The second rotation is scheduled to start early enough so students are able to choose their summer research and possible thesis advisers. The aims of the two rotations are to get to know research topic and tools used in various labs, to develop laboratory skills, and to find a thesis mentor. Rotations require a minimum 8 hour per week presence in lab/office. One of the rotations can be with a faculty/adjunct faculty outside the program. The Examining Committee for the scholarly paper consists of at least two faculty members, who will read the scholarly paper and attend the oral presentation. The paper should provide an informative review of the research topic selected by the candidate in consultation with his/her academic and research advisors. The bibliography is a particularly important part of the paper and should include the most significant references to the topic. The length of the paper is expected to be approximately 20 double space pages (12-point font) with 1-inch margins. The presentation is to last approximately one hour and can be part of regularly scheduled seminar series such as the Informal Statistical Mechanics Seminar or the Nonlinear Dynamics Seminar. Two faculty must be present and there should be sufficient time for questions and discussion. For the thesis M.S. degree, students must complete a written masters thesis, maintain a B average, complete 30 graduate credits

Milchberg, Howard M.
Mullin, Amy
Murphy, Thomas E.
Nigam, Sumant
Raghavan, Srinivasa R.
Reutt-Robey, Janice
Rolston, Steven L.
Roy, Rajarshi
Salamanca-Riba, Lourdes G.
Seo, Eun-Suk
Sita, Lawrence R.
Vedernikov, Andrei
Zachariah, Michael R.

Associate Professor
Cumings, John
Dimitrakopoulos, Panagiotis
Martinez-Miranda, Luz
Ouyang, Min
Paglione, Johnpierre
Rabin, Oded
Upadhyaya, Arpita
Yu, Yihua Bruce

Assistant Professor
Munday, Jeremy
Nie, Zhihong
Rodriguez, Efrain
Wang, Yu Huang
White, Ian

Associate Research Scientist
Gudipati, Murthy S.

Research Professor
Coplan, Michael A.
Sengers, Jan V.

Research Assistant Professor
Koeth, Timothy

Adjunct Professor
Clark, Charles
Nossal, Ralph J.

University Affiliate
Arif, Muhammad
Bienfang, Joshua C.
Celotta, Robert J.
Fraser, Gerald T.
Germer, Thomas A.
Julienne, Paul S.
Knutson, Jay R.
Lee, Jennifer C.
Lett, Paul
Levine, Zachary H.
McClelland, Jabez J.
Migdall, Alan L.
Mohr, Peter J.
Neuman, Keir C.
Nico, Jeffrey
Nossal, Ralph J.
Phillips, William D.
Pushin, Dmitry
Sansonetti, Craig J.
Silver, Richard M.
Stiles, Mark D.
Tan, Joseph N.
Tarrio, Charles
Thompson, Alan K.
Tjandra, Nico
Williams, Carl
Zimmerberg, Joshua
Zimmerman, Neil M.

including: 1.Six credits of CHPH799 - (M.S. thesis research) 2.24 course credits 3.Two credits of seminar, can be included in the non-course credits 4.Advanced laboratory course 5.Advanced course at the 600 level or above The Thesis Examining Committee is to consist of at least three faculty members including the research advisor. The Examination Committee will review the M.S. thesis, attend the oral presentation and participate in the defense of the thesis. The thesis is to consist of an introduction to the field of research with which the student is engaged, a clear statement of the problem under study, the objectives of the research, the approach taken, original results, interpretation, discussion, and conclusions. A concise review of the literature, and a bibliography of the most important literature should also be included. The M.S. thesis has no set length, but is typically 30 to 40 pages. The format of the thesis (font, margins, etc.) must follow the University of Maryland Thesis and Dissertation Style Guide.

Doctor of Philosophy (Ph.D.)
Students must pass the written Qualifying Examination passed at the Ph.D. level, normally taken at the beginning of the second year. Maintain a B average, present a scholarly paper research presentation, 24 graduate course credits including: 1. Two lab rotations, 2. Two credits of seminar, 3. Advanced laboratory course, 4. Advanced course outside of the student's main field of study at the 600 level or above. In order to advance to Ph.D. candidacy, the student must submit a scholarly paper and make an oral presentation. The paper and presentation are evaluated by a candidacy committee consisting of at least two faculty members, generally including the advisor and a member of the advisory committee. Students with a well-developed thesis topic and research results are expected to include these results together with further research plans in their paper and presentation. Students less far along with research will present background material and summaries of the research areas in which they will be working. A concise review of the literature is expected, along with a bibliography of the most important literature. The length of the paper is expected to be between approximately 20 double space pages (12-point font) with 1-inch margins. The paper is to be submitted to the candidacy committee at least two weeks before the date of the oral presentation. The presentation is to last approximately 50 minutes and can be part of regularly scheduled seminar series such as the Informal Statistical Mechanics Seminar or the Nonlinear Dynamics Seminar. Two members of the candidacy committee must be present and there should be sufficient time for questions and discussion. Within 12 to 18 months after beginning Ph.D. research, the student is to select a Ph.D. Thesis Examination Committee. 12 credits of CHPH899 (Ph.D. dissertation research, only available after advancement to Ph.D. candidacy) Written Ph.D. dissertation. The format of the dissertation (font, margins, etc.) must follow the University of Maryland Thesis and Dissertation Style Guide.

Facilities and Special Resources

Incoming students are provided with private desk space and up to date computer facilities. There is a wide array of advanced equipment associated with the various research groups in the Program including scanning probe microscopes, high resolution spectrographs, ultra-short high-power lasers, multi-coincidence electron scattering spectrometers, and a fully equipped light-scattering laboratory.

Financial Assistance

Teaching and research assistantships are available for qualified students. There are also University and Chemical Physics Fellowships and fellowships in Biophysics (in cooperation with the National Institutes of Health) and Atomic, Molecular and Optical Science (in cooperation with the National Institute of Standards and Technology).

Contact Information

Requests for further information concerning the Chemical Physics Program can be obtained by writing to:

Professor Garegin A. Papoian, Director
Physical Science Complex I Building, Room 1149
MD 20742
Telephone: (301) 405-8667
Fax: (301) 314-9363
gpapoian@umd.edu

http://www.chemicalphysics.umd.edu/

Courses: CHPH

Related Programs and Campus Units

Biophysics
Chemistry
Biochemistry
Physics

Chemical and Life Sciences (CLFS)

Faculty:

Abstract

The Master of Chemical and Life Sciences is an online content-based masters program for high school science teachers that provides in depth knowledge of current research areas in the biological, biochemical and biomedical sciences. The courses cover subject matter as diverse as genetic engineering and gene therapy to chemistry, ecology and the concepts of biocomplexity. University faculty who are experts in the field will lead discussion sessions on topics of current interest with significant social impact. Topic examples include the positive and negative aspects of genetically engineered foods and their safety , the development of new energy sources and the ethical and moral issues involved in cloning and the handling of genetic information. The program also provides a set of laboratory experiences that facilitates the presentation of many of these concepts in the classroom. Aside from the laboratory experiences, all courses will be offered exclusively through distance education as online courses. Our infrastructure provides a web based asynchronous program. Teachers who desire to update and advance their knowledge or who must complete an advanced degree or graduate courses, will find that this program meets their needs. In addition to our general program we offer focused Areas of Concentration in Biology and in Chemistry. During the course of studies towards a degree students may earn Credentials by taking a series of focused courses.

Admissions Information

Admission Information for the Master of Chemical and Life Sciences can be found here: http://oes.umd.edu/professional-programs/chemical-and-life-sciences/clfs-admission-information UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS). Additional requirements can be found here: http://oes.umd.edu/professional-programs/chemical-and-life-sciences/clfs-admission-information#international

Application Deadlines

Fall:
There is no application deadline .

Application Requirements

In addition to a suitable undergraduate education and experience admission to the degree program requires the successful completion of either CLFS 510, Concepts of Modern Biology, or CLFS 520, Concepts in Modern Chemistry, gateway review classes; or a passing grade of B or better on either of the admissions exams based on CLFS 510 and CLFS 520. Suitable GRE scores will also be accepted to satisfy admission requirements (GRE scores are not required!). Upon application and the submission of documentation all applicants will be granted Provisional Admission to the program while they satisfy other admission requirements

Degree Requirements

MASTER OF CHEMICAL AND LIFE SCIENCES (MCLFS)
Students with a thorough and up to date understanding of biology or chemistry, and who are admitted without condition*, may elect to take the appropriate Admission Exam. The Admission Exams are generally based on the content of CLFS 510, Concepts in Modern Biology or CLFS 520, Concepts in Modern Chemistry. Students who feel that they can benefit from a review may take CLFS 510, Concepts in Modern Biology or CLFS 520, Concepts in Modern Chemistry. A passing grade (B) on either the Admission Exam or CLFS 510/520 is sufficient for admission to the MCLFS program as a degree-seeking student. *Students with undergraduate grade point averages below 3.0, who have not previously demonstrated superior performance in graduate courses, will be required to take CLFS 510 or CLFS 520. (Note: as a 500-level course this cannot be used to meet the credit requirements of the MCLFS program.) Students may take individual courses in the MCLFS program as Advanced Students. Up to 12 credits may be taken in this way. A maximum of six credits from other institutions may be transferred in with approval of the Director. (See: Transfer Form) The program's curriculum consists of 30 credit hours selected from the list below (not including CLFS 510 or CLFS 520). Included in the 30 hours are 6 credits of CLFS 710, Experimental Biology, or CLFS 720, Experimental Chemistry, or the equivalent, and the completion of a scholarly paper. No more than six hours of CLFS 608 Seminar credits may be counted towards the required 30 credits.

Financial Assistance

Dr. Paul Mazzocchi Professor Emeritus, Director, Master of Chemical and Life Sciences
pmazzocc@umd.edu

http://www.clfs.umd.edu/grad/mlfsc/

Office of Extended Studies
0132 Main Administration Building
MD 20740
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/chemical-and-life-sciences

Courses:

Chemistry (CHEM)

Abstract

The Department of Chemistry and Biochemistry offers graduate study leading to the PhD degree in Chemistry. Our PhD program in Chemistry has a strong core in the traditional fields of chemistry, including analytical chemistry, chemical physics (in cooperation with the Institute of Physical Sciences & Technology), environmental chemistry, inorganic chemistry, nuclear chemistry, organic chemistry and physical chemistry. In addition to these traditional areas we also have interdisciplinary programs in contemporary areas

Faculty:

Chair
Reutt-Robey, Janice

Director
Vedernikov, Andrei

Distinguished University Professor
Alexander, Millard H.

such as nanoscience, chemical biology, energy sciences, materials chemistry, theoretical chemistry, and supramolecular chemistry.

Admissions Information

Admission to graduate study at the University of Maryland requires a minimum of a Bachelor of Science (B.S.), Bachelor of Arts (B.A.) or equivalent degree. Previous coursework must normally include a minimum of 30 semester or 40 quarter hours of chemistry, with at least 1 year of physical chemistry, 1 year of organic chemistry and 1 semester of inorganic chemistry, as well as laboratory courses in organic chemistry and physical chemistry. A laboratory course in analytical chemistry is also preferred. The following application materials are required: 1) Graduate application; 2) personal statement; 3) general Graduate Record Examination (GRE) scores; 4) grade transcripts; 5) 3 letters of reference. The chemistry subject GRE score is not required but it can be helpful for a complete evaluation. Applicants from non-English speaking countries must also present the results of the Test of English as a Foreign Language (TOEFL) and the Test of Spoken English (TSE).

Application Deadlines

Fall:
Applications must be received by January 1 (**January 1 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General required
2. 3 Letters of Recommendation
3. Resume or CV
4. Transcripts
5. "Personal Statement".
6. TOEFL scores for international students

Degree Requirements

Doctor of Philosophy (Ph.D.)

Twenty-one course credit hours, with twelve credits of research, two seminar presentations, an oral exam for advancement to candidacy, and a dissertation defense are required for the doctoral degree.

Master of Science (M.S.)

The M.S. degree program offers both the thesis and non-thesis options. Twenty-four course credits, including 2 seminar credits and 6 research credits are required for either option. The thesis option requires a seminar presentation and an oral defense of the thesis. The non-thesis option requires writing a "scholarly paper" that is reviewed by a committee of 3 faculty members. Copies of specific regulations are available from the Department of Chemistry and Biochemistry or on the internet at: www.chem.umd.edu.

Facilities and Special Resources

The Department has state-of-the-art research facilities to support research in the fields listed above. Facilities include "clean" rooms for environmental sample analysis, X-ray crystallographic instrumentation, numerous mass spectrometers, numerous NMR spectrometers including 400, 500, 600 and 800 MHz Fourier-transform NMR

Lorimer, George H.
Weeks, John D.

Professor
Blough, Neil V.
Davis, Jeffery T.
DeShong, Philip R.
Dickerson, Russell R.
Eichhorn, Bryan W.
Falvey, Daniel E.
Fenselau, Catherine C.
Fourkas, John T.
Fushman, David
Isaacs, Lyle D.
Jarzynski, Christopher
Lee, Sang Bok
Mignerey, Alice C.
Mullin, Amy
Ondov, John M.
Reutt-Robey, Janice
Salawitch, Ross J.
Sita, Lawrence R.
Vedernikov, Andrei
Walters, William B.
Zachariah, Michael R.

Associate Professor
Dayie, Kwaku
Julin, Douglas A.
Kahn, Jason D.
Lee, Cheng S.
Papoian, Garegin

Assistant Professor
Nie, Zhihong
Wang, Yu Huang

University Affiliate
Wang, Lai-Xi

Professor Emeritus
Bellama, Jon M.
DeVoe, Howard J.
Greer, Sandra C.
Grim, Samuel O.
Hansen, J. Norman
Helz, George R.
Jarvis, Bruce B.
Mazzocchi, Paul H.
Miller, Gerald R.
O'Haver, Thomas C.
Tossell, John A.

spectrometers; an XPS spectrometer, Atomic Force Microscopes, ultracentrifuges, analytical optical spectrometers, and a state-of-the-art computer graphics facility.

Departmental research is supported by a departmental server and many individual faculty work stations. The Department has access to electronics shop and campus machine shops. The Chemistry Library has an extensive collection in chemistry, biochemistry and other fields. Electronic access to journals and literature search databases is available. A Macintosh workstation facility (25 units) is available in the Department for student/faculty use.

Financial Assistance

Ph.D. candidates are normally supported on graduate teaching assistantships during their first year in graduate school. Teaching assistants usually instruct undergraduate laboratory and recitation classes and receive in return a tuition waiver of ten credits each semester, a salary and health care benefits. In subsequent years, Ph.D. candidates are typically supported on graduate research assistantships or fellowships. Financial assistance is not typically available to M.S. candidates.

Contact Information

Information on requirements and research interests of the faculty may be obtained at www.chem.umd.edu or from:

Ms. Elizabeth Hontz, Graduate Coordinator
Graduate Programs Office 0129 Chemistry Building,
University of Maryland- College Park,
MD 20742
Telephone: (301) 405-7022 and (301) 405-1028
Fax: (301) 314-9121
ehontz@umd.edu

http://www.chem.umd.edu/

Courses: CHEM BCHM

Related Programs and Campus Units

Biophysics
Biological Sciences
Biochemistry
Chemical Physics

Classics (CLAS)

Abstract

The Department of Classics offers a graduate program of study with specializations in Latin or Latin and Greek, leading to the Master of Arts degree. The program provides students with advanced study of the Latin and/or Greek languages and literatures in the context of a broader and deeper knowledge and understanding of Greek and Roman culture and civilization. In addition to advanced courses in language, each student will be required to take coursework in related disciplines outside of the Classics Department. Some individual programs may require more than 30 hours. Students may choose one of two tracks toward the degree: Latin or Latin and Greek.

Faculty:

Chair
Doherty, Lillian E.

Distinguished Scholar-Teacher
Hallett, Judith P.

Professor
Doherty, Lillian E.
Hallett, Judith P.
Staley, Gregory A.

Associate Professor
Adler, Eric

Admissions Information

In addition to the general requirements for admission established by the Graduate School (see "General Information" section in this catalog), applicants must demonstrate a proficiency in translating the ancient language(s) at the advanced undergraduate level.

Application Deadlines

Fall:
Applications must be received by August 15 (**February 1 preferred**) .
Spring:
Applications must be received by November 15 (**August 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. No Test
2. 3 Letters of Recommendation
3. Writing Sample

Degree Requirements

Master of Arts (M.A.)

The Latin program requires a minimum of 30 hours of approved coursework, which can include six credit hours of thesis research. Six credits of Latin may be taken at the 400 or 600 level. An additional twelve credits of Latin must be in courses at the 600 level or higher. Six credits must be from courses in a related field such as classical civilization, Latin pedagogy, art and archaeology, history, linguistics, philosophy, or any other approved allied course. These courses must be taken at the 400 level or higher. The final six credits may be taken as thesis credits or as two additional 600 level Latin courses. Students must take LATN 4/672 (History and Development of the Latin Language) and any two of the following: LATN 4/620, 4/622, 4/623, 4/624, 4/630.

The Latin and Greek program requires a minimum of 33 hours of approved coursework, which can include six credits of thesis research. Three credits in the major language, e.g. Latin, may be taken at the 400 or 600 level. Fifteen additional hours in the major language must be at the 600 level or higher. Six credits in the minor language, e.g. Greek, may be at the 400 or 600 level. Six additional hours in the minor language must at the 600 level or higher. Three credits must be from a course in a related field such as classical civilization, Latin pedagogy, art and archaeology, history, linguistics, philosophy, or any other approved allied course. This course must be taken at the 400 level or higher. The final six credits may be taken as thesis credits or as two additional 600 level courses in the major language. Students choosing Latin as their major language must take LATN 4/672 (History and Development of the Latin Language) and any two of the following: LATN 4/620, 4/622, 4/623, 4/624, 4/630.

Facilities and Special Resources

The Baltimore-Washington, D.C., area boasts of several outstanding classical libraries. Located in Washington, D.C., are the Center for Hellenic Studies, the Byzantine Library of Dumbarton Oaks, and the Library of Congress. Students may also use the Eisenhower Library on the campus of the Johns Hopkins University in Baltimore.

Financial Assistance

Teaching assistantships and several categories of fellowships are available for outstanding applicants. Contact the graduate director or the department chair for details.

Assistant Professor
Barrenechea, Francisco
Bravo III, Jorge J.

Professor Emerita
Stehle, Eva Marie

Professor Emeritus
Lee, Hugh M.

Associate Professor Emeritus
Rutledge, Steven H.

Contact Information

For more specific information on the program, please call or write:

Prof. Judith P. Hallett, Director of Graduate Studies
1210 Marie Mount Hall, University of Maryland,
College Park
MD 20742
Telephone: (301) 405-2024
Fax: 301-314-9084
jeph@umd.edu

http://www.classics.umd.edu/

Courses: CLAS LATN GREK

Related Programs and Campus Units

Art History and Archaeology
History
English Language and Literature
Womens Studies
Philosophy
Jewish Studies
Comparative Literature
Medieval and Early Modern Studies

Clinical Audiology (CAUD)

Faculty:

University Affiliate
Department of Hearing and Speech Sciences

Abstract

(Note: Applicants for the M.A. program in Speech-Language Pathology, please see SPLA; Applications for the Hearing and Speech Sciences Ph.D., please see HESP). Advanced graduate study in clinical audiology available through the Department of Hearing and Speech Sciences includes the Doctor of Audiology (Au.D.) program and the Doctor of Philosophy (Ph.D.) in Clinical Audiology. The Au.D. doctoral program is available to post-baccalaureate or post-masters students, whereas the Ph.D. in Clinical Audiology is available only to those students pursuing the dual degree program (see below). A "fast-track" Au.D. option (CAUD) is available to post-masters students meeting certain criteria specified below. Both of these graduate programs provide curricula designed to meet the educational and clinical experiences required to obtain the Certificate of Clinical Competence in Audiology (CCC-A) of the American-Speech-Language-Hearing Association and Board Certification in Audiology by the American Board of Audiology (ABA). A dual degree program is available to CAUD students. Those students in the program who wish to pursue the Ph.D. in Clinical Audiology will earn the Au.D. at the point in doctoral training when they have completed all of the academic, clinical, and research requirements for this first professional degree.

Admissions Information

Admissions to the graduate program in Clinical Audiology is on a very competitive basis. Students admitted to the Au.D. or Clinical Ph.D. program in Audiology must have a minimum grade point average of 3.2 from a master's degree program, or 3.4 from a baccalaureate program in hearing and speech sciences, or related discipline. In addition to the Graduate School requirements, the Department requires all applicants to furnish scores on the Graduate Record Examination. Admission to both programs is confined to fall matriculation, Prospective applicants should note that decisions on admissions are made in early March. Students must submit application materials for the fall semester by January 5. Applicants with a background in the hearing and speech sciences or a related

field are considered for admission to the Au.D. and Dual Degree (Au.D./Ph.D.) programs, which usually require four and six years of graduate study, respectively. As of the fall of 2015, we will no longer be accepting students who have not fulfilled their undergraduate requirements. For more information on the prerequisite course requirements, please see our website: hesp.umd.edu. A "fast track" of the Doctor of Audiology (Au.D.) program is available to practicing audiologists who have previously earned their M.A. Applicants to this fast track must have a graduate degree in Audiology with a minimum grade point average of 3.2 in graduate work, and either the ASHA Certificate of Clinical Competence in Audiology (CCC-A) or a valid state license to practice audiology. Admissions requirements further include a minimum of two years of full time (32 hrs/week) post-masters professional audiological experience during the two years immediately preceding the application to the program and three letters of recommendation supporting these experiences. Students may enroll in the post-M.A. Au.D. program on a part-time basis.

Application Deadlines

Fall:
January 15 .
Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

All applicants to the CAUD graduate program are required to furnish GRE scores taken within the last five years, three letters of recommendation, official transcripts from all undergraduate and graduate studies, and a statement of purpose. Additionally, professional audiologists applying to the post-MA program must also submit evidence of ASHA certification or state licensure, and evidence of two years of full-time professional work as a clinical audiologist.

Degree Requirements

Doctor of Philosophy in Clinical Audiology (Ph.D.)
The Dual-degree (Au.D./Ph.D.) program requires 60 credit hours of graduate coursework, 6 credit hours of pre-candidacy research, 12 credit hours of dissertation research, 12 credit hours of clinical practicum registration, and 18 credit hours of full-time clinical internship registration, for a total of 108 credit hours. The Dual-degree program is designed to meet requirements specified in the Standards for the Certificate of Clinical Competence in Audiology of the American Speech-Language-Hearing Association and in the Handbook for Board Certification in Audiology of the American Board of Audiology. The program also meets all requirements of the Graduate School. Ph.D. students must develop an individual study plan with the approval of a faculty Program Planning Committee, pass comprehensive examinations, and complete a dissertation and oral defense. Full-time students are expected to complete the program in approximately 6 years. Students will earn an Au.D. degree on the way to the Ph.D. degree after they have successfully completed academic coursework, pre-candidacy research, clinical practicum, the 4th-year clinical externship, and comprehensive examinations. The Department of Hearing and Speech Sciences also offers the traditional Doctor of Philosophy degree, with major emphasis in either speech, language or hearing, for those students seeking careers in research or higher education without clinical training. For information about the Ph.D. in Hearing and Speech Sciences, please see HESP.

Doctor of Audiology (Au.D.)
The Au.D. program for post-BA students requires 57 credit hours of graduate coursework, 4 credit hours for a doctoral capstone research project, 14 credit hours of clinical practicum registration, and 18 credit hours of full-time clinical internship registration, for a total of 93 credit hours. The Au.D. curriculum meets requirements specified in the Standards for the Certificate of Clinical Competence in Audiology of the American Speech-Language-Hearing Association, as well as those required for Board Certification in Audiology from the American Board of Audiology. Au.D. students must pass comprehensive examinations and complete a capstone research project. Full-time

students are expected to complete the program in four years. The Au.D. program for returning students who already possess an M.A. degree in Audiology requires 30 credit hours of graduate coursework and 4 credit hours for a capstone research project. There is no minimum requirement of supervised clinical practicum experience, although clinical practicum will be available to students as needed.

Facilities and Special Resources

The Department's facilities include (1) numerous modern research laboratories equipped to support research in the areas of: acoustic phonetics, psychoacoustics, cochlear implants, hearing aids, infant and adult speech perception, neuropsychology, language, voice, fluency and electrophysiology. There are six sound-attenuating chambers and one electrically-shielded chamber devoted to research with humans, which are all integrated with computers and peripheral equipment for acoustic signal development, signal analysis, presentation and on-line data collection; (2) a Departmental library; (3) the Hearing and Speech Clinic at UMCP: this clinic serves as the initial practicum site for all students pursuing clinical training. The Clinic includes multiple audiological test suites equipped for diagnostic testing, a complete hearing aid dispensary, a group rehabilitation room, and state-of-the-art equipment for behavioral and electrophysiological diagnostic testing, as well as hearing aid selection and fitting. Ten speech and language diagnostic and therapy rooms are integrated with observation areas; and (4) an on-site language pre-school (LEAP, the Language-Learning Early Advantage Program), also equipped for observation. Students pursuing clinical training in Audiology will also have access to the Audiology Service, Division of Audiology-Head and Neck Surgery, of the University of Maryland and University Hospital in Baltimore (UMB), for part-time clinical rotations or full-time clinical externships. This Service provides a full range of auditory and vestibular diagnostic and rehabilitative services in a large metropolitan hospital setting. Students also engage in clinical activities in the Audiology Section of the Clinical Center as well as intramural research programs of the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health. All of the clinical and research facilities are potentially available for the conduct of student-directed research projects, or for student participation in faculty-initiated research projects. Additional research and clinical opportunities are available at Walter Reed National Military Medical Center, the Johns Hopkins University School of Medicine, and at other facilities in the Washington and Baltimore metropolitan areas. The Library of Congress, the National Library of Medicine and the libraries of various medical schools in the Washington-Baltimore area supplement the University's extensive libraries at College Park. The Department of Hearing and Speech Sciences participates in the Center for the Comparative and Evolutionary Biology of Hearing Training Program(C-CEBH), the Neuroscience and Cognitive Sciences graduate program (see NACS), and the Maryland Language Science Center, and has ties to the Center for the Advanced Study of Language (CASL); these connections afford students the opportunity to work with faculty in other departments at the University of Maryland, College Park, or at UMB.

Financial Assistance

A limited number of graduate assistantships are available through the Department. Assistantships that carry teaching, research or clinical responsibilities are awarded on a competitive basis. Students may also seek assistantships from other units on campus or scholarships sponsored by Federal agencies (e.g., NIDCD) or private foundations (e.g., American Speech-Language-Hearing Foundation; American Academy of Audiology Foundation).

Contact Information

Additional information about the Doctoral Program in Clinical Audiology (Au.D. or Ph.D.) may be obtained by contacting Sandra Gordon-Salant, Ph.D., Director of the Doctoral Program in Clinical Audiology, or by e-mailing the program at hespadmissions@umd.edu; extensive information about the program and faculty are available at the Department's web site: http://www.hesp.umd.edu

Sandra Gordon-Salant, Ph.D., Director Of Graduate Studies & Director of Doctoral Program in Clinical Audiology
0100 Lefrak Hall
Department of Hearing and Speech Sciences College Park
MD 20742
Telephone: 301-405-4214
Fax: 301-314-2023
hespadmissions@umd.edu

http://www.hesp.umd.edu

Courses: HESP

Related Programs and Campus Units

Communication
Neuroscience and Cognitive Science
Hearing and Speech Sciences
Speech-Language Pathology

Clinical Psychological Science (MPPS)

Faculty:

Co-Director
Blanchard, Jack J.
Felton, Julia W.

University Affiliate
Felton, Julia W.
Malesa, Elizabeth
Vijay, Aditi

Abstract

The University of Maryland is proud to offer a Master of Professional Studies (MPS) in Clinical Psychological Science, the only master's-level degree that focuses explicitly on clinical psychological science. The goal of the MPS program is to provide rigorous training in clinical psychology, including coursework in evidence-based psychological assessment and interventions, as well as state-of-the-art research methods and critical thinking skills. Students take 10 courses (two per term) over the course of 15 months. Courses are taught in the evenings at the College Park campus and are designed for working professionals who desire advanced knowledge in clinical science to enter, advance, or expand their career options in the mental health field...

Admissions Information

The Masters in Clinical Psychological Science program offers Fall admissions only. The application deadline for Fall enrollment is March 2, 2015. International student application materials are due February 1, 2015. Invitations to interview for the program will be sent to select students by March 9, 2015.

UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program.
International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS). Additional Requirements can be foundhere.

Application Deadlines

Application Requirements

Applicants are asked to submit an essay, undergraduate transcripts, two letters of recommendation, and a resume or CV. GRE scores are not required.

Degree Requirements

()

Facilities and Special Resources

Classes are held at the College Park campus in the evenings, after traditional working hours.

Financial Assistance

Contact Information

Julia Felton, Ph.D. Director
Biology-Psychology Building
MD 20740
Telephone: 301-405-7190
jfelton1@umd.edu

http://psyc.umd.edu/graduate/master-professional-studies-mps

Office of Extended Studies
0132 Main Administration Building
MD 20740
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/clinical-psychological-science

Courses:

Communication (COMM)

Abstract

The department takes as its intellectual focus the strategic use of discourse in the public sphere. Departmental research focuses in communication science, public relations, and rhetoric and political culture. The Department encourages applications for graduate study from students wishing to pursue interests identified with one of these foci. The graduate program in Communication is designed for students whose educational objective is the Ph.D. degree (currently the program does not admit students whose degree objective is the M.A.) Most graduates of the doctoral program pursue academic careers; however, some work in public policy research and other professions requiring highly developed research skills.

Admissions Information

Students must hold a Bachelor's or Master's degree (or the equivalent) prior to enrollment in the Ph.D. program. Although most applicants to the program will have earned a degree in the communication field, others with an interest in studying communication may be admitted (with the possibility of additional courses assigned to remedy deficiencies). Admission to the Ph.D. program is based on the student's prior academic record, GRE scores, letters of recommendation, statement of goals and research interests, sample of scholarly writing, and other information relevant to the applicant's likelihood of completing the program. TOEFL is required of all international applicants (except applicants from the United Kingdom, Commonwealth Caribbean, Ireland, Canada, Australia, or New Zealand whose first language is English).

Faculty:

Chair
Toth, Elizabeth L.

Director
Sawyer, David B.

Professor
Parry-Giles, Shawn J.
Parry-Giles, Trevor S.
Toth, Elizabeth L.
Wolvin, Andrew D.

Associate Professor
Hample, Dale J.
Khamis, Sahar Mohamed
Liu, Brooke Fisher
Maddux, Kristjana L.
Nan, Xiaoli

Assistant Professor
Aldoory, Linda
Anderson, Lindsey
Joyce, Nicholas
Seate, Anita Atwell
Westcott-Baker, Amber
Yang, Michelle Murray

Research Professor
Kendall, Kathleen

Application Deadlines

Fall:
For best consideration applications and all supporting materials should be received by December 1. (applications will be reviewed through February 1) (**December 1 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Official Transcripts from all Colleges attended
2. GRE General
3. 3 Letters of Recommendation
4. Sample of Scholarly Writing
5. Personal statement Statement of research interests
6. TOEFL for all international applicants (except applicants from the United Kingdom, Commonwealth Caribbean, Ireland, Canada, Australia, or New Zealand whose first language is English). The Test of Written English (TWE) is required for those not completing the IBT TOEFL.

Senior Lecturer
Waks, Leah

University Affiliate
Anderson, Lindsey
Cai, Deborah A.
Gaines, Robert N.
Liu, Meina
Sommerfeldt, Erich

Professor Emerita
Grunig, Larissa A.

Professor Emeritus
Fink, Edward L.
Grunig, James E.
Klumpp, James F.

Degree Requirements

Master of Arts (M.A.)

The Department of Communication is not currently admitting students whose terminal degree objective is the M.A. A minimum of 30 hours is required for the master's degree. Students who select the thesis option must complete and successfully defend an original research project that contributes to knowledge of communication. Those who select the non-thesis option must complete a comprehensive examination and a research paper in their area of interest. All students, regardless of option, are required to master the fundamentals of communication inquiry, including knowledge of communication research methods.

Doctor of Philosophy (Ph.D.)

The Ph.D. requires (1) course work to prepare the student for a research program in communication, including work in a cognate discipline, and research methods; (2) a comprehensive examination that certifies mastery of disciplinary knowledge and preparation for independent research; and (3) completion and successful defense of a dissertation that advances knowledge of communication.

Facilities and Special Resources

The campus provides extensive computer resources and excellent library collections in communication. In addition, the Washington metropolitan area provides research and laboratory facilities for studying communication unmatched by other departments in the discipline.

Financial Assistance

Most departmental financial aid is in the form of graduate assistantships. However, a limited number of fellowships are available.

Contact Information

For additional information on graduate study in Communication, contact:

Dr. Kristy Maddux (for current graduate students)
2130 Skinner Bldg
Department of Communication, University of Maryland

MD 20740
Telephone: 301-405-6533
klmaddux@umd.edu

Dr. Brooke Liu (for prospective students)
2130 Skinner Bldg
Department of Communication, University of Maryland
MD 20740
Telephone: 301-405-6524
bfliu@umd.edu

Ray Chang, Program Management Specialist
2130 Skinner Building
College Park, MD 20742-7635
Telephone: (301) 405-0870
Fax: (301) 314-9471
commgrad@deans.umd.edu

http://www.comm.umd.edu

Courses: COMM COMM

Related Programs and Campus Units

English Language and Literature
Clinical Audiology

Community Planning and Historic Preservation (CPHP)

Faculty:

Dual degree programs, such as Community Planning and Historic Preservation, can have complicated requirements and applications. It is recommended that you consult with the Program Directors of each program before proceeding to apply.

Application deadline for the program is December 15 for International Applicants and January 1 for the Domestic Applicants.

The School has requested a differential tuition for in-state students in order to defray the higher cost of offering the dual degree program. The tuition differential, if approved, will be announced to all enrolled students, and will only be applied going forward for the semester following the announcement.

Abstract

The dual degree combines course work from the Architecture and Urban Studies and Planning programs to enable a student to complete both the Master of Architecture and Master of Community Planning degrees with fewer credits than it would take to complete the two separately.

Students of the dual-degree program acquire specialized knowledge tailored to understanding the urban environment from several perspectives. Students learn how social, economic and political forces have led to the development of human habitats. The emphasis on urban design in the dual-degree program yields an education that is particularly applicable for persons interested in the revitalization of metropolitan areas and their center cities.

Admissions Information

The administrative code for the dual degree of Master of Community Planning and Master of Historic Preservation is "CPHP." Applicants must be admitted by both programs to pursue this dual degree but only one application is required.

A writing sample of at least 10-30 pages is required. This can be previous individual academic or professional work. It does not necessarily have to be related to historic preservation or community planning, however a related topic is preferred. The writing sample should demonstrate the ability to analyze a problem/question and clearly communicate your findings.

Application Deadlines

Application Requirements

1. Statement of Purpose - specific to interest in dual degree
2. Graduate Record Examination (GRE)
3. Transcript(s)
4. Letters of Recommendation (3)
5. CV/Resume
6. Writing Sample
7. TOEFL/IELTS/PTE (international applicants only)

Degree Requirements

Community Planning and Historic Preservation (Dual Degree) (M.C.P. and M.H.P.)

The dual degree combines course work from the Urban Studies and Planning and Historic Preservation programs to enable a student to complete both the Master of Community Planning and Master of Historic Preservation degrees with fewer credits than it would take to complete the two separately.

The dual degree requires 60 credits, which can be completed in five semesters with summer coursework (see below) More information on required courses and curriculum may be found on the School of Architecture, Planning and Preservation website at: http://arch.umd.edu. Fall Semester HISP 600 Seminar in Hist.Preservation (3) HISP 610 Historical Research Methods (3) URSP 605 History and Theory (3) URSP 606 Econ Planning (3) Spring Semester 2 HISP 640 Preservation Law (3) URSP 600 Research Methods (3) URSP 603 Land Use Planning (3) URSP 662 Developing countries* (3) Summer Session URSP _____ Elective taken now or as second elective in semester four (3) Fall Semester 3 HISP 680 Preservation Economics or URSP 661 Economic Development**(3) HISP 670 Conservation (3) URSP 601 Research Methods (3) URSP 604 Planning Process (3) Spring Semester 4 HISP 630 Preservation Policy and Planning (3) HISP 700 Independent Study (3) URSP _____ Elective (3) Summer Session HISP 660 or URSP 709 Internship***(3) (If choose non-credit, may take an additional elective) Fall Semester 5 HISP 650 or URSP 708 Studio***(6) URSP _____Elective (3) *Or an elective may be taken in this slot and URSP673 Social Planning taken in semester five instead of elective. ** Prerequisite URSP 606 or URSP 660 *** With permission of advisor

Facilities and Special Resources

The School of Architecture, Planning and Preservation is ideally located between Washington, DC, and Baltimore and surrounded by a number of historic communities and a varied physical environment. The resulting opportunity for community planning and historic preservation is unsurpassed.

The School's resources include design workstations for each architecture student, a model shop, a digital fabrication lab, and both PC and MAC computer labs with REVIT,

ARGUS, GIS, Maptitude and other design programs available. The School's library contains some 57,000 monographs and 6,000 current periodicals, making it one of the major architectural libraries in the nation. The National Trust Library for Historic Preservation, housed in McKeldin Library, contains 11,000 volumes and 450 periodical titles. The Colvin Institute holds the entire library offerings of the Urban Land Institute and access to all the case studies published by ULI. The slide collection includes approximately 430,000 slides on architecture, landscape architecture, planning, and technical subjects. The interdisciplinary National Center for Smart Growth Education and Research is based in the School offering perspectives and opportunities to engage important issues facing urban and regional planning.

Financial Assistance

The School of Architecture, Planning, and Preservation offers a limited and varying number of teaching and research assistantships, scholarships, fellowships, and internships. Applicants should apply for financial assistance when submitting the application for admission.

Scholarship determinations are made at the time of application and admission. Scholarships are generally awarded on a per course basis and commitments are made at the time of admission and apply to the entire program, subject to academic performance. Periodically there are named scholarships provided by various organizations or companies.

In addition, there are work opportunities both on, and off campus, and they are relatively plentiful. However, students in the dual degree program may find it difficult to complete their degree requirements timely if they are working off campus, or more than 10 hours per week.

Applicants should inquire as to the availability of funding for the term they are starting.

Contact Information

Find additional information on program offerings, degree requirements, admissions, and financial aid on the School's Web site (www.arch.umd.edu).

Schedule a visit and tour online at: http://arch.umd.edu/arch/prospective-students-arch.

Sign up to receive an invitation to our Graduate Open House online at: http://arch.umd.edu/mapp/graduate-inquiry-form

For further information about the Community Planning Program, please contact Dr. Jim Cohen, Community Planning Program Director, jimcohen@umd.edu, 301-405-8000.

For further information about the Historic Preservation Program, please contact Dr. Donald Linebaugh, Historic Preservation Program Director, dwline@umd.edu, 301-405-8000.

Jim Cohen, PhD, Director, Community Planning Program
University of Maryland School of Architecture, Planning and Preservation
Building 145 College Park
MD 20742
Telephone: 301-405-8000
jimcohen@umd.edu

http://arch.umd.edu

Donald Linebaugh, PhD, Director, Historic Preservation Program
University of Maryland School of Architecture, Planning and Preservation Building 145

College Park
MD 20742
Telephone: 301-405-8000
dwline@umd.edu

http://arch.umd.edu

Courses:

Comparative Literature (CMLT)

Abstract

A separate degree program in the English Department, the Comparative Literature Program is committed to the comparative and transnational study of literature and other media. Combining its own dynamic resources with the particular strengths of the English Department and other units in the College of Arts and Humanities, the Program focuses especially on Western Hemispheric and Transatlantic Studies and on Diasporic and Postcolonial Studies. Students in the Program work in at least two languages and national literatures, one of them Anglophone. The Comparative Literature PhD Program complements the current PhD Program in English, giving students a place to pursue true comparative studies. Students seeking admission to the PhD Program in Comparative Literature must demonstrate advanced language proficiency before entry into the Program, and commit themselves to achieving a high degree of intellectual expertise in two or more languages and national literatures. Graduates are as likely to find academic positions in departments of foreign languages as they are to find them in English. A doctoral degree in Comparative Literature can uniquely prepare them for a profession that more and more studies literatures and cultures within a globalized, transnational context. Students entering this small, elite PhD program will already hold an MA degree either in English or in another language/literature; students seeking admission with the BA should contact the Director of the Comparative Literature Program to discuss alternative possibilities for achieving the MA in preparation for the PhD program. Applicants interested in the Program should apply directly to Comparative Literature, not English.

Admissions Information

Applicants should have a strong background in arts and humanities. Students will not be admitted to the program without demonstrated proficiency in English and at least one other language. Each student must submit a critical writing sample (in English), three letters of recommendation, evidence of language proficiency, and GRE scores. International applicants must also submit TOEFL scores. **Applicants will no longer be admitted to the Master of Arts program in Comparative Literature as of Fall 2006; admission is available to the Ph.D. Students with a BA should contact the director of the Comparative Literature program to discuss alternative possibilities for achieving an MA in preparation for the PhD program.**

Application Deadlines

Fall:
Applications must be received by January 16, 2012 .
Spring:
This program does not accept applications for this semester.
Summer:
This program does not accept applications for this semester.

Application Requirements

1. **GRE General**
2. **3 Letters of Recommendation**
3. **Critical Writing Sample**

Faculty:

Director
Jelen, Sheila

Distinguished University Professor
Levinson, Jerrold

Professor
Collins, Merle
Donawerth, Jane L.
Harrison, Regina
Igel, Regina
Kauffman, Linda
Ray, Sangeeta
Richardson, Brian
Wang, Orrin

Associate Professor
Baer, Hester
Carpenter, Faedra
Eades, Caroline M.
Gaycken, Oliver
Jelen, Sheila
Mason, Michele M.
Nunes, Zita
Ontiveros, Randy
Papazian, Elizabeth
Passannante, Gerard
Valiavitcharska, Vessela V.
Zakim, Eric S.

Assistant Professor
Anischenkova, Valerie
Arsenjuk, Luka
Balachandran Orihuela, Sharada
Barrenechea, Francisco
Bauer, Ralph R.
Schonebaum, Andrew

Affiliate Professor
Cohen, William A.
Doherty, Lillian E.
Hallett, Judith P.
Orlando, Valerie

Affiliate Associate Professor
Frisch, Andrea
Long, Ryan F.

Instructor
Robinson, Eugene S.

University Affiliate
Anischenkova, Valerie
Arsenjuk, Luka
Baer, Hester
Keshavarz, Fahtemeh

4. **Statement of Language Proficiency**
5. **Statement of Goals, Research Interests, and Experiences**

Papazian, Elizabeth
Schonebaum, Andrew

Professor Emerita
Berlin, Adele
Peterson, Carla L.

Degree Requirements

(mfa)

Doctor of Philosophy (Ph.D.)
The Ph.D. degree normally entails at least 18 credits of course work (beyond M.A. courses) and 12 credits of dissertation research. Students take one course in Methodology (3 credits); one course in Theory (3 credits); two courses in Early Modern Literature (6 credits); and two courses in Modern Literature (6 credits). The designations early modern and modern remain flexible to accommodate different literary histories. In each of the two general periods, at least one course must be taken in the English Department in Anglophone or Comparative Literature and at least one course outside of the English Department in another language/literature. Students can use six credits of MA work to satisfy distribution requirements (though not total credit number requirements). Advising will address the depth, breadth, and coherence of each student's course plan and, if necessary, coordination among different histories of the early modern and modern.

Facilities and Special Resources

The Comparative Literature Program combines the benefits of a small department with the opportunities available at a large research university located in suburban Washington, D.C. Students have access to such University resources as the rare books and special collections of McKeldin Library, the Program for Africa and Africa in the Americas, the Women's Studies Graduate Certificate program, and the Meyerhoff Center for Jewish Studies. Area resources include the extensive archival collections of the Library of Congress, the U.S. Archives, and the Folger Institute, as well as museums, galleries, embassies and cultural institutions in the Washington area and in the Baltimore-Philadelphia-New York corridor.

Financial Assistance

Comparative Literature students are eligible for graduate assistantships and university fellowships. Depending on available resources and the student's own expertise, teaching and research assistantships may be available either in Comparative Literature or in an affiliated department.

Contact Information

For more specific information about the program, contact:

Sheila Jelen, Director, Program in Comparative Literature, Associate Professor of English and Jewish Studies
2116 Tawes Hall, University of Maryland
College Park
MD 20742
Telephone: (301) 405-3839
Fax: (301) 314-7539
cmltgrad@deans.umd.edu

http://www.english.umd.edu/academics/cmlt

Courses: CMLT

Related Programs and Campus Units

French Modern Studies

Computer Science (CMSC)

Abstract

The Computer Science Department's graduate program is ranked among the top in the nation and in the top ten among public universities. Both M.S. and Ph.D degrees are offered, and almost all full-time students receive financial aid in the form of assistantships, fellowships, and grants. The Department has strong research programs in the following areas: artificial intelligence, computer systems and networking, database systems, programming languages, software engineering, scientific computing, algorithms and computation theory, computer vision, geometric computing, graphics, and human-computer interaction.

Admissions Information

Admission and degree requirements specific to the graduate programs in computer science are described on our website, http://www.cs.umd.edu/Grad/catalog.html. A strong background in mathematics and theoretical computer science is necessary. The general Graduate Record Examinations (GRE's) are required. The subject GRE is recommended, but not required.

Application Deadlines

Fall:
Applications must be received by December 15 (**December 1 preferred**) .
Spring:
Only students attending UM for the fall Semester may be considered for the spring semester. Applications must be received by October 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. GRE Subject highly recommended
3. 3 Letters of Recommendation

Degree Requirements

Doctor of Philosophy (PhD)

The program milestones include a nine-course qualifying sequence, a preliminary oral examination on a proposal for a dissertation and reading list in three related areas, and the dissertation defense. The number and variety of courses offered each semester enable students and their advisors to plan individualized programs.

Master of Science (M.S.)

The master's program offers two options: 1) 24 hours of coursework and completion of a thesis, or 2) 30 hours of coursework and completion of a scholarly paper.

Facilities and Special Resources

The department is located in the A.V. Williams building. Each office has one or more wall plates, which contain ethernet, fiber optic, and telephone outlets. Most larger offices and labs have dedicated ethernet switches installed in the room, with two or more ethernet cables to each desk. Ethernet and fiber outlets are connected to ethernet switches

Faculty:

Chair
Khuller, Samir

Professor
Agrawala, Ashok K.
Aloimonos, John
Bederson, Benjamin B.
Bhattacharjee, Samrat
Cleaveland II, W. Rance
Davis, Larry S.
De Floriani, Leila
Dorr, Bonnie J.
Elman, Howard C.
Gasarch, William
Hollingsworth, Jeffrey K.
Jacobs, David
Khuller, Samir
Mount, David M.
Nau, Dana S.
O'Leary, Dianne P.
Perlis, Donald R.
Porter, Adam A.
Pugh, William
Reggia, James A.
Roussopoulos, Nicholas
Samet, Hanan
Shankar, A.Udaya
Shneiderman, Ben A.
Srinivasan, Aravind
Subrahmanian, Venkatramana
Sussman, Alan
Varshney, Amitabh

Associate Professor
Arbaugh, William
Deshpande, Amol
Duraiswami, Ramani
Foster, Jeffrey S.
Getoor, Lise
Hicks, Michael
Katz, Jonathan
Keleher, Peter J.
Kruskal, Clyde P.
Memon, Atif M.
Pop, Mihai
Purtilo, James M.
Spring, Neil
Tseng, Chau-Wen

Assistant Professor
Froehlich, Jon
Pop, Mihai

Adjunct Associate Professor
Guimbretiere, Francois

Affiliate Professor
Baras, John S.
Barg, Alexander
Chellappa, Ramalingam
Druin, Allison J.
JaJa, Joseph F.
Oard, Douglas William
Raschid, Louiqa
Resnik, Philip S.

running at 100 Mbit and Gigabit ethernet speeds, and running on a gigabit ethernet backbone. Cisco routers connect the building switches to the campus network and the internet via gigabit ethernet.

The campus has a wireless ethernet network covering the entire building and much of campus, allowing mobile computing users to remain connected to the network while in meetings, conference rooms, hallways, visiting other offices, or roaming certain parts of the University of Maryland campus. The wireless network supports the 802.11a, 802.11b, and 802.11g standards.

Current research facilities include workstations running Sun Solaris, Redhat Linux, Apple OSX, and Microsoft Windows. There are over 100 terminals on graduate student desks that provide a choice of Redhat Linux, Microsoft Windows, or Sun Solaris as their native desktop operating system. Four public laser postscript printers with integrated black and white scanners, a color scanner, and a color laser printer are available for use. A public workstation is available for burning CD and DVD discs.

Financial Assistance

Financial aid, in the form of teaching assistantships, research assistantships, and fellowships, is offered to qualified applicants. Almost all full-time students receive some type of financial aid.

Contact Information

For information on degree programs and graduate assistantships contact:

Graduate Office
1151 A.V. Williams Building
MD 20742
Telephone: (301) 405-2664
csgradof@cs.umd.edu

http://www.cs.umd.edu/Grad

Courses: CMSC

Related Programs and Campus Units

Engineering: Systems Engineering
Neuroscience and Cognitive Science
Applied Mathematics & Statistics, and Scientific Computation

Tits, Andre L.
Vishkin, Uzi
Weinberg, Amy S.

Affiliate Associate Professor
Barua, Rajeev K.
Cukier, Michel
Cummings, Michael P.
Golbeck, Jen
Lin, Jimmy
Yeung, Donald

Affiliate Assistant Professor
Rand, William

Distinguished University Professor Emeritus
Stewart, Gilbert W.

Professor Emerita
Basili, Victor R.
Zelkowitz, Marvin V.

Professor Emeritus
Kanal, Laveen N.
Miller, Raymond E.
Minker, Jack

Couple and Family Therapy, M.S. (FCFT)

Abstract

The M.S. in Couple and Family Therapy (CFT) provides students with the coursework and supervised clinical training typically required in states with Marriage and Family Therapy licensure. The program is accredited by the Commission on Accreditation for Marriage and Family Therapy Education of the American Association for Marriage and Family Therapy (AAMFT). The Couple and Family Therapy M.S. program requires 48 credits for the non-thesis option and 51 credits for the thesis option. Completion of the program, which includes the 2-year internship, generally requires 2 years.

The mission of the CFT Master's program is to prepare competent, effective therapists for clinical practice and advancement of the marriage and family therapy discipline. The program seeks to train professionals who demonstrate superior therapeutic skills, ethical

Faculty:

Professor
Epstein, Norman B.

Associate Professor
Leslie, Leigh A.

Assistant Professor
Mittal, Mona

Instructor
Werlinich, Carol A.

integrity, intellectual curiosity, and a sincere commitment to working with families from diverse populations.

Admissions Information

The Department seeks students who are imaginative, intelligent, and highly motivated men and women with a desire for challenge, a commitment to excellence, and a well-developed sense of social responsibility. Prior coursework in family science, human development, psychology, introduction to therapy or counseling, and statistics courses are useful in preparation for graduate CFT work. We are fortunate to attract gifted students who are concerned about social and ethical issues and who view their future profession in a broad context.

Students are selected on the basis of:

- a bachelor's degree in family science or a related discipline
- a minimum 3.0 (out of 4.0) grade point average for the Baccalaureate degree
- the quality of previous undergraduate and/or graduate coursework
- the strength of their GRE scores
- letters of recommendation (3)
- relevant work experience
- professional goals congruent with those of the program

Students also have the option of applying jointly to the CFT program and the Department's Family Science Ph.D. program (see application procedures for the doctoral program).

Application Deadlines

Application Requirements

Students who wish to apply for the CFT Program must complete the University of Maryland Graduate Application online, which includes 3 letters of recommendation, the statement of goals and research interests, and official transcripts from all institutions attended. **Applicants must also download and complete the additional Couple and Family Therapy Application. A hard copy of this application (the Couple and Family Therapy application) should be mailed directly to Dr. Norman Epstein in the Center for Healthy Families at the following address:**
1142 School of Public Health, Bldg. 255
College Park, MD 20742

The Department of Family Science admits students in the fall semester only. The deadline for submitting the Graduate School Application and the Couple and Family Therapy Application Form is **January 15** (January 1 for international students and citizens living abroad). Students are strongly encouraged to apply before the deadline date.
The top candidates for the program are invited to an interview (typically in February) with CFT faculty and current graduate students. Graduate assistantships and tuition waivers are available for the most qualified students.

Application Procedures for the Couple and Family Therapy (CFT) Program at the University of Maryland, College Park:
Step #1: Apply to the University's graduate school

1. Go to http://www.gradschool.umd.edu/gss/admission.htm
2. Complete the online application (a $75 non-refundable application fee will be processed with your application

3. Mail all transcripts reflecting all undergraduate and graduate work completed or in progress to:
   University of Maryland at College Park
   Enrollment Services Operations
   Application for Graduate Admission
   0130 Mitchell Building
   College Park, MD 20742
4. Standardized test scores (GREs) are to be sent directly from Educational Testing Service (if no category exists on ETS form, please fill in "other" and write FMSC, code 5814).
5. GREs must be taken in time to reach our department before the January 15th deadline. - Allow 2 weeks to receive your scores.
6. Letters of recommendation are to be submitted online with your graduate application or mailed directly to Graduate Admissions.
7. All information provided in this application will be directly sent by Graduate Admissions to the Department of Family Science for review (you do not need to mail additional hard copies of the graduate school application to the department).

Step #2: Apply to the CFT program in the Department of Family Science

1. Download and Print the Couple and Family Therapy Application (this is available on the FMSC website sph.umd.edu/department/fmsc/cft-admissions)
2. Complete application and mail to:
   Department of Family Science
   Attention: Dr. Norman Epstein
   University of Maryland, College Park
   1142 School of Public Health
   College Park, MD 20742

All application materials are due by January 15. Meeting this deadline guarantees full consideration. **Incomplete applications will not be considered.**

Degree Requirements

Master of Science (M.S.)

The CFT curriculum has three parts: didactic coursework, clinical practica, and supervised client contact. The minimum total credits required are 48 for the non-thesis option and 51 for the thesis option. Didactic coursework is taken in conjunction with 15 credits of clinical practicum seminars and 9 credits of supervision of clinical work. In the clinical practicum, theory is applied to specific case material, with faculty supervision providing support and oversight of assigned cases.

Supervised client contact begins in the student's first semester. Clinical students are required to gain 400 hours of face-to-face client contact, and 250 of these hours must be relational (with couples or families). The Center for Healthy Families, the couple and family therapy clinic operated by the Department, offers the opportunity to gain these hours. Clinical students receive 100 hours of supervision, both individual and group, for their client contact hours. Supervision in the Department's clinic is provided through a range of techniques including case discussion, one-way mirror observation, video review, co-therapy, and telephone consultation during live sessions. Students may choose to do some of their clinical work in a variety of available externship sites in the local area.

Couple and Family Therapy students may pursue the thesis or non-thesis option. For thesis option students, 6 semester hours are thesis research credits taken as FMSC 799. The thesis must be approved and then defended in an oral examination. Non-thesis option students take the 3 credit FMSC 789. Non-thesis students must complete a written and oral therapy case presentation.

Facilities and Special Resources

The University's close proximity to the nation's capital, the state capital in Annapolis, federal executive departments, and headquarters of national professional and public interest associations provide research and internship placements for studying family policy unmatched by any other graduate program in the discipline. The Washington-Baltimore metropolitan area offers rich opportunities for research on culturally and socioeconomically diverse families. The campus and department have excellent computer facilities. Students have ready access to the University's extensive library systems, as well as holdings from the Library of Congress, the National Institutes of Health, National Library of Medicine, National Archives, and many other library collections.

Center for Healthy Families: This Center is the training and research arm of the Couple and Family Therapy Program in the Department of Family Science. Departmental graduate students and faculty provide clinical and educational services to families from surrounding communities in this state-of-the-art facility. Master's and doctoral students use data collected at the Center for research projects.

Financial Assistance

Graduate Assistantships are available to students admitted into the CFT program.

Contact Information

For additional information, please contact: Dr. Norman Epstein (CFT Program Director), or Dr. Kevin Roy (Graduate Director).
Department of Family Science
1142 School of Public Health, Bldg. 255
College Park, MD 20742
Phone: 301-405-3672
Fax: 301-314-9161
http://www.sph.umd.edu/fmsc

Program Director of the Couple and Family Therapy M.S. Program
Norman B. Epstein, Ph.D.
Department of Family Science
1142 School of Public Health, Bldg. 255
College Park
MD 20740
Telephone: 301-405-4013
Fax: 301-314-9161
nbe@umd.edu

Courses:

Creative Writing (CRWR)

Abstract

The MFA in Creative Writing provides a professional course of study for graduate students seeking to perfect their ability to compose poems, stories, and novels. While primarily affording students intensive studio or practical work within their chosen genre, the MFA in Creative Writing requires that students incorporate such work with a traditional study of literature. The goal of the MFA in Creative Writing is to provide an atmosphere in which students can both hone their skills as writers and gain a theoretical and historical understanding of their craft.

Admissions Information

Faculty:

Director
Plumly, Stanley

Associate Director
Weiner, Joshua

Distinguished University Professor
Plumly, Stanley

Professor
Collier, Michael R.
Norman, Howard

In addition to fulfilling Graduate School requirements, applicants to the M.F.A. degree program should present a 3.0 GPA. Applicants should submit a writing sample, for fiction, 25 pages, or for poetry, 10 poems, to the Office of the Creative Writing Program. Applications must be received by January 15. Admission is for the Fall semester only.

Associate Professor
Arnold, Elizabeth
Casey, Maud
Weiner, Joshua

Assistant Professor
Feitell, Merrill Beth

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General recommended
2. 3 Letters of Recommendation
3. Writing Sample

Degree Requirements

Master of Fine Arts (M.F.A.)

The M.F.A. degree program requires 36 credit hours of graduate work. The program balances courses in literature with writing workshops (30 hours), and requires a creative thesis (six hours). It offers concentrations in fiction and in poetry.

Facilities and Special Resources

Resources for research in the College Park and Washington, D.C. area are unsurpassed. The university's libraries hold over 2,000,000 volumes. In addition to the outstanding holdings of the Library of Congress, the area also offers the specialized resources of the Folger Shakespeare Library, Dumbarton Oaks, the National Archives, the Smithsonian Institution, and the National Center for the Study of the Visual Arts.

UMCP is a member of the Consortium of Institutions in the Washington area, which permits graduate students at College Park to enroll in courses at other universities for graduate credit at UMCP. Graduate students in English also may take courses for graduate credit at the Folger Institute of Renaissance and Eighteenth-Century Studies, which runs a series of seminars by distinguished scholars each year.

Financial Assistance

The Graduate School awards a small number of fellowships to candidates nominated by the various departments. In conjunction with the Graduate School, the English Department also awards teaching assistantships, the primary form of financial aid. Currently, about 85 teaching assistantships are awarded each year, and about 25 of these go to incoming students or to enrolled students who have not previously held them.

Contact Information

Additional information on admission, degree requirements, and financial aid can be obtained from:

Lindsay Bernal, Academic Coordinator
Creative Writing Program, 2116D Tawes Hall, Department of English, University of Maryland, College Park, MD 20740
MD 20740

Telephone: 301-405-3820
Fax: 301-314-7539
lbernal@umd.edu

http://www.english.umd.edu/creativewriting

Courses: ENGL

Criminology and Criminal Justice (CRIM)

Abstract

The program of graduate study leading to a Traditional Master of Arts and Doctorate of Philosophy degrees in the area of Criminology and Criminal Justice is intended to prepare students for research, teaching and professional employment in operational agencies within the field of criminal justice. This program combines an intensive background in a social science discipline such as criminology, criminal justice, sociology, psychology and public policy with graduate-level study of selected aspects of crime and criminal justice.

In addition, the Department offers a joint J.D./M.A. degree with the University of Maryland Francis King Carey School of Law, located in Baltimore.

A recent study of Department M.A. and Ph.D. alumni reveals that master's degree graduates have found employment in both public and private institutions in virtually every kind of activity associated with the criminal justice system: research; teaching; federal, state and local law enforcement; courts; corrections; private security; and funded programs. Ph.D. graduates have found employment mostly in teaching, research, and government agency administration.

Admissions Information

In addition to the general Graduate School rules, special admission requirements include the Graduate Record Examination (GRE - General exam), a major in a social science discipline and nine hours of coursework in appropriate areas of criminal justice.

Application Deadlines

Fall:
For Funding Consideration - Completed Applications must be received by December 1. All other Applications must be received by December 15 .
International Applicant Final Deadline December 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General Exam
2. TOEFL/IELTS Exam (International Students)
3. Official Transcript(s)
4. Personal Statement of Goals/Purpose
5. CV/Resume
6. 3 Letters of Recommendation

Degree Requirements

Faculty:

Graduate Director
Johnson, Brian D.

Distinguished Scholar-Teacher
Lafree, Gary D.

Distinguished University Professor
Laub, John H.
Sherman, Lawrence W.
Thornberry, Terence P.

Professor
Dugan, Laura
Gottfredson, Denise C.
Lafree, Gary D.
McGloin, Jean M.
Paternoster, Raymond
Reuter, Peter H.
Simpson, Sally S.
Thornberry, Terence P.

Associate Professor
Johnson, Brian D.
Loughran, Thomas A.
Maimon, Daivd
Wish, Eric D.
Xie, Min

Assistant Professor
Nakamura, Kiminori
Porter, Lauren

Instructor
Brooks, Laure Weber

Professor Emeritus
Wellford, Charles F.

Master of Arts and Doctor of Jurisprudence (M.A./J.D.)
Please contact the program for more information.

Doctor of Philosophy (Ph.D.)

The Ph.D. applicant who has already earned an MA/MS degree must have completed two statistics, two research methods, and two theory courses, one of each being at the Master's level. At the discretion of the Graduate Admission Committee of the Department, deficiencies in some of the above areas may be made up by non-credit work at the beginning of the program. Students whose highest degree is a BA/BS may choose to apply for entry either into the Traditional Masters program or directly into the Ph.D. program. Students admitted directly into the Ph.D. program will complete the requirements of the Traditional Masters program before beginning Ph.D.-level work.

In addition to the general Graduate School requirements, competence in research methodology and in quantitative techniques is expected for the completion of the Ph.D. degree, as well as competence in theory and the criminal justice field. The necessary coursework is determined on the basis of the student's previous preparation, needs and interests. The candidate is also required to pass comprehensive examinations.

Master of Arts (M.A.)

For the M.A. applicant, the undergraduate major must have included at least one course each in theory, statistics and research methods. The general plan of study for the Traditional M.A. is as follows: 30 semester hours of courses consisting of: 1) five required courses that must be passed with a "B" or better (including two statistics courses); 2) six hours of thesis credit; and 3) three elective courses.

Facilities and Special Resources

The Department has various opportunities for graduate students to participate in current projects. Recent students have worked in research centers at the Maryland State Commission on Criminal Sentencing Policy, National Consortium for the Study of Terrorism and Responses to Terrorism (START), and the National Institute of Justice. In addition, our faculty maintain an array of ongoing, funded research projects where students can assist. These resources provide numerous opportunities for students to engage in policy development, research, and professional activities.

Financial Assistance

Graduate research assistantships, teaching assistantships, scholarships, and fellowships are available to select individuals applying to our doctoral program. In recent years many admitted doctoral students receive funding through assistantships, and some may be awarded supplemental scholarships or fellowships offered by the Department, the BSOS Dean's Office, or The Graduate School. Applications should be received by December 1st of the preceding Fall term for best consideration.

Contact Information

A brochure describing the Department of Criminology and Criminal Justice and its programs is available upon request. Please direct all inquiries to criminologydept@umd.edu.

Graduate Program Coordinator, Lauren Grant
2220 LeFrak Hall
MD 20742
Telephone: (301) 405-6838
Fax: (301) 405-4733
criminologydept@umd.edu

http://www.ccjs.umd.edu

Courses: CCJS

Dance (DANC)

Faculty:

Head
Bradley, Karen Kohn

Associate Professor
Bradley, Karen Kohn
Mansur, Sharon F.
Pearson, Sara
Widrig, Patrik

Assistant Professor
Fang, Adriane
Phillips, Miriam

Lecturer
Jackson, Paul D.
Mayes, Alvin

Professor Emerita
Warren, Anne W.

Abstract

The School of Theatre, Dance, and Performance Studies offers a Master of Fine Arts degree in Dance, focusing on developing highly skilled teaching artists with concentrations in either performance or choreography. The program is designed to give outstanding students advanced training, experience in teaching, and opportunities for creative growth. The School also offers MA, MFA, and PhD degrees in theatre. For more information visit the School website at http://tdps.umd.edu.

Aimed primarily at modern or contemporary dancers with a high skill level and background in creating and performing at a professional level, the MFA Dance program integrates studio, theory, and pedagogical practices, culminating in the third year in both a shared concert of original work(s) and an off-campus internship in a professional organization, agency, company, or school.

The competencies that students learn during the program will allow them to teach a broad range of dance and dance-related subjects after they graduate. They will be able to produce and present dance in a number of contexts and modalities, on campus, in professional and site-specific venues, and in the community.

The program provides many performance opportunities, which are directed by faculty members, visiting guest artists and fellow students. Important emphasis is given to dance theory and practices in western and world dance and to the study of current issues. We wish our graduates to exhibit a high degree of insight into the cultural contexts in which dance has developed in the past and continues to develop today.

Students are expected to spend a significant amount of time learning about technical aspects of dance as well as promotion and house management and the myriad of other organizational details that go into producing a dance performance. They will be actively involved in the practical application of this knowledge as part of their training.

The program is highly selective (four students per year) and auditions are required. The MFA is a full time three-year program. Financial support is available for each student selected.

Admissions Information

Applicants should have a strong undergraduate preparation in technique and dance composition. They should have completed the following undergraduate courses or their equivalent: improvisation, kinesiology, dance teaching methods, dance production, Laban Movement Analysis, and two semesters of dance history or one semester of history and one of dance philosophy, ethnology or aesthetics. Undergraduate deficiencies will be considered on an individual basis.

Application Deadlines

Fall:
Applications must be received by February 1 .
Spring:
This program **does not** accept applications for this semester.

Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. No entrance exams required (GRE or similar)
2. No writing samples required at time of application
3. 3 Letters of Recommendation to be submitted online
4. Mandatory Audition, Interview with spontaneous Writing Sample - usually the last Saturday of the month of February
5. 15 minute sample of choreography available online

Degree Requirements

Master of Fine Arts (M.F.A.)
Students enrolled in the program must complete a total of 60 credit hours of study with a minimum cumulative grade point average of 3.0 to graduate and will be assessed on a regular basis to determine their progress. Graduation from the program requires the successful completion of a final project demonstrating a synthesis of craft and artistic understanding as well as professional competence in the area of concentration. Final projects consist of: (1) the thesis project consisting of the public presentation of a body of dance works choreographed by the candidate, along with written documentation of the project as agreed upon with the thesis adviser; (2) the presentation of an online portfolio of selected indicators of artistry and pedagogy. The thesis project work may be presented in one or more publicly attended events, in a shared capacity with another MFA candidate. Candidates are responsible for the organization of all production elements involved in the presentation of the project.

Facilities and Special Resources

The location of campus, eight miles away from Washington D.C., places the School a half hour away from America's arts district where one may study and enjoy a wide variety of offerings of ballet, modern and world dance. Washington D.C. is also a center for policy and participation in the public discourse about the arts.

Financial Assistance

Four candidates are admitted each Fall, and each of the four are offered financial support through teaching assistatnship appointments, or if available, fellowships. Assistantships are never guaranteed and funding can change year to year. All qualified applicants may be nominated for Graduate School fellowships; the deadline for all applications is posted on the TPDS website annually. For more information, visit http://tdps.umd.edu or call 301-405-6675.

Contact Information

The Guidelines for the Graduate Program provide course requirements, examination procedures and descriptive materials for the M.F.A. program. For specific information, contact:

Karen K. Bradley, Head of MFA in Dance
School of Theatre, Dance, and Performance Studies Clarice Smith Performing Arts Center
University of Maryland College Park
MD 20742-1615
Telephone: (301) 405-0387
Fax: (301) 314-9599
kbradley@umd.edu

http://tdps.umd.edu

Ms. Stephanie Bergwall, Coordinator of Graduate Services
School of Theatre, Dance, and Performance Studies 2809 Clarice Smith Performing Arts Center University of Maryland
College Park
MD 20742-1615
Telephone: 301-405-6675
Fax: 301-314-9599
bergwall@umd.edu

http://tdps.umd.edu

Courses: DANC

Related Programs and Campus Units

Dance
Theatre

Doctor of Veterinary Medicine (DVM) Program (VMED)

Faculty:

Visiting Professor
Stephen F. Sundlof, DVM, Ph.D.

Abstract

The Virginia-Maryland Regional College of Veterinary Medicine offers a four-year full-time program (curriculum) leading to the Doctor of Veterinary Medicine (D.V.M.) degree. The first three years are taught at Virginia Tech University in Blacksburg, VA in a case-based and traditional lecture/laboratory format. At the end of the first year, students choose a track - small animal, food animal, equine, mixed species and public/corporate veterinary medicine. Considerable flexibility exists for a student to tailor their curriculum to meet individual needs and interests. The senior year (clinical) is 12 months in length. For detailed information on the Doctor of Veterinary Medicine (DVM) program, please visit the Virginia-Maryland Regional College of Veterinary Medicine at: http://www.vetmed.vt.edu/

Admissions Information

For information on applying to the Doctor of Veterinary Medicine (DVM) program, please visit the Virginia-Maryland Regional College of Veterinary Medicine website at: http://www.vetmed.vt.edu/acad/dvm/index.asp

Application Deadlines

Fall:
Applications must be received by October 1 .
This program **does not** accept applications for this semester.

Application Requirements

Please visit the Virginia-Maryland Regional College of Veterinary Medicine website at: http://www.vetmed.vt.edu/acad/dvm/req.asp#adm

Degree Requirements

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Please visit the Virginia-Maryland Regional College of Veterinary Medicine website at:
http://www.vetmed.vt.edu/acad/dvm/req.asp#adm

Financial Assistance

Contact Information

Joyce Bohr Massie DVM Program Admissions Coordinator
Virginia-Maryland Regional College of Veterinary Medicine DVM Admissions Office
(0442) Blacksburg, VA 24061
VA 24061
Telephone: (540) 231-4699
Fax: (540) 231-9290
dvmadmit@vt.edu

http://www.vetmed.vt.edu/acad/dvm/req.asp#adm

Courses:

Economics (ECON)

Abstract

The Economics Program offers graduate study leading to the Doctor of Philosophy degree. During the course of study toward the Ph.D., doctoral students also have the opportunity to obtain a Master of Arts degree. Areas of specialization include: behavioral and experimental economics, comparative institutional economics, development, econometrics, economic history, industrial organization, international trade and finance, labor economics, microeconomic theory, macroeconomics, political economy, public economics, and resource and environmental economics.

Admissions Information

By the application deadline, applicants should have completed advanced undergraduate courses in microeconomics, macroeconomics, and econometrics. Applicants are also expected to have completed the equivalent of three semesters of calculus, a semester of linear algebra, and a semester of differential equations. The majority of admitted students have also completed course work in real analysis or other upper-level mathematics. The Graduate Record Examination (GRE) Aptitude test is required. Submitted GRE scores must be valid through January 15, 2016. All of the Department's graduate students are full-time students.

Application Deadlines

Fall:
The final online application deadline for the Ph.D. program in Economics for both international and domestic applicants is midnight (Eastern Standard Time) on January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

GRE General; TOEFL or IELTS where applicable; Official Transcripts; 3 Letters of Recommendation; Statement of Goals, Research and Experiences; Fall grades where applicable Resume or Curriculum Vitae; Econ Supplemental Forms

Faculty:

Chair
Cropper, Maureen L.

Associate Chair
Shea, John

Graduate Director
Shea, John

Distinguished University Professor
Cropper, Maureen L.
Haltiwanger, John C.
Prucha, Ingmar R.

Professor
Ausubel, Lawrence M.
Cramton, Peter C.
Drazen, Allan
Galiani, Sebastian
Ham, John
Hellerstein, Judith K.
Hulten, Charles R.
Jin, Ginger Zhe
Kalemli-Ozcan, Sebnem
Kuersteiner, Guido Markus
Limao, Nuno
Murrell, Peter
Vincent, Daniel R.
Wallis, John J.

Associate Professor
Arouba, Boragan
Chao, John C.
Coughlin, Peter J.
Filiz Ozbay, Emel
Kaplan, Ethan
Kearney, Melissa
Ozbay, Erkut Y.
Shea, John
Sweeting, Andrew
Urzua, Sergio

Degree Requirements

Master of Arts (M.A.)
Our department offers admission only to students interested in earning a Ph.D. Our program is not designed for students who are interested only in a Master's degree. However, our Ph.D. students may obtain an M.A. degree during their program, either as a terminal degree for students leaving the Ph.D. program, or as an intermediate sign of achievement for students who are continuing in the Ph.D. program. For students who are interested in applied economics, but are not pursuing a Ph.D., the University of Maryland offers a professional masters in applied economics. This program is designed for working professionals; it is not appropriate for a Ph.D. in economics. Contact masters@econ.umd.edu or visit http://masters.econ.umd.edu for more information

Doctor of Philosophy (Ph.D.)

The Department of Economics at the University of Maryland prepares graduate students for careers in teaching, research, and government service. The course of study provides a solid foundation in economic theory, econometrics and applied fields. The Ph.D. program requires: (1) written examinations in microeconomic and macroeconomic theory, taken during the summer after the first year of study, (2) completion of a three-course sequence and a written examination or field paper in a major field, (3) completion of a two-course sequence in a minor field, (3) completion of an econometrics sequence, (4) an additional supporting course in a theoretical or applied field, and (5) a dissertation. In the third year, students begin directed research by participating in workshops appropriate to their dissertation research.

Financial Assistance

Many students entering our graduate program receive financial aid. Some students receive graduate assistantships, requiring about 15 hours of teaching or research service per week. Graduate assistantships provide a stipend and a very attractive package of fringe benefits that include medical insurance and full tuition remission. Other students receive first-year fellowships. These fellowships also include a stipend, medical insurance and tuition remission, but do not require students to work as a teaching or research assistant. In most cases, fellowships convert to assistantships beginning in the second year. Students who enter our program with financial aid are guaranteed financial aid for two years in all cases, and for five years conditional on satisfactory progress in the program.

Contact Information

For more informaton on our program, please go to our website at http://www.econ.umd.edu/landing/Graduate

Coordinator of Graduate Studies in Economics
3114E Tydings Hall
MD 20742
Telephone: (301) 405-3544
Fax: (301) 405-3542
econgrad@deans.umd.edu

http://www.econ.umd.edu/landing/Graduate

Courses: ECON

Related Programs and Campus Units

Applied Mathematics & Statistics, and Scientific Computation

Assistant Professor
Goldberg, Jessica
Guiteras, Raymond P.
Lee, Soohyung
Saffie, Felipe
Stevens, L. Luminita
Turner, Lesley

Faculty Research Associate
Clement, Cynthia

Professor Emerita
Bergmann, Barbara R.
Dardis, Rachel

Professor Emeritus
Almon, Clopper
Bennett, Robert L.
Betancourt, Roger R.
Brechling, Frank P.
Clague, Christopher K.
Cumberland, John H.
Harris, Curtis C., Jr.
Kelejian, Harry H.
McGuire, Martin C.
Polakoff, Murray E.
Schelling, Thomas C.
Schwab, Robert M.
Wonnacott, Paul

Associate Professor Emeritus
Meyer, Paul A.

Education: Curriculum and Instruction (EDCI)

Abstract

The Department of Curriculum and Instruction (EDCI) merged with the Department of Education Policy Studies (EDPS) to form the Department of Teaching and Learning, Policy and Leadership (TLPL). For more detailed and up-to-date information about programs and resources see the TLPL website at http://education.umd.edu/TLPL.

The programs related to Curriculum and Instruction (EDCI) offer graduate study leading to the following degrees and certificates: Master of Arts (thesis and non-thesis), and Master of Education (M.Ed.). The Department offers a variety of programs individually designed to meet graduate students' personal and professional goals which may include educational research, teaching, supervising, providing leadership as curriculum specialists within the disciplines, teacher education or consulting at all levels of instruction: elementary, secondary and higher education.

Areas of concentration include art education (M.Ed. only), elementary/middle school education, history/social studies education, English education, Applied Linguistics and Language Education (ALLE) - world languages education and teaching English as a second language (TESOL), mathematics education, minority and urban education, teacher education/professional development (doctoral only), reading education, and science education. The Department also supports three master's degree programs for candidates who have a bachelor's degree in fields other than education and wish to become certified teachers. In addition, there is a six-course Post-Baccalaureate Certificate in literacy coaching designed to prepare experienced, highly qualified middle and high school teachers to serve as literacy coaches in low performing middle and high schools.

NOTE: This section includes information about the M.A. and M.Ed. programs previously associated with the Department of Curriculum and Instruction; students interested in these programs should apply to EDCI, though TLPL now sponsors these programs. Students interested in the Department's new Ph.D. program should go to Education: Teaching and Learning, Policy and Leadership (TLPL) in the graduate catalog.

Admissions Information

To be recommended for full admission to a master's program, a minimum undergraduate grade point average of 3.0 is required. The Graduate Record Exam (GRE) is required of applicants to all EDCI MA programs but they are not required for M.Ed. programs. Certification-track programs require passing Praxis scores, or approved substitution. Scores on the Graduate Record Examination (verbal, quantitative, writing) should be at the 50th percentile or higher. Because graduate programs are highly competitive, successful applicants often score considerably higher. Students who do not meet one of these requirements, but show other evidence of outstanding potential, may be considered for provisional admission. Admission of qualified applicants is based on their competitive ranking to limit enrollments to available faculty resources. See the description of the EDCI programs and admissions overview on the TLPL website for more detailed information:http://www.education.umd.edu/TLPL/.

Admissions and Deadline Notes:

Applications for the **TESOL and Minority and Urban Education (MUE) M.Ed. programa** are accepted for **Fall only**.

Faculty:

Dean
Wiseman, Donna

Chair
Hultgren, Francine H.

Associate Chair
Croninger, Robert G.
O'Flahavan, John F.

Professor
Afflerbach, Peter P.
Campbell, Patricia F.
Chazan, Daniel
Dreher, Mariam Jean
MacSwan, Jeff
McGinnis, James R.
Saracho, Olivia N.
Sullivan, Denis F.
Valli, Linda R.
Wiseman, Donna

Associate Professor
Brantinger, Andrew
Clark, Lawrence
Elby, Andy
Ketelhut, Diane Jass
Martin-Beltran, Melinda
McCaleb, Joseph L.
O'Flahavan, John F.
Peercy, Megan
Slater, Wayne H.
Turner, Jennifer

Assistant Professor
Brown, Tara
Clegg, Tamara
Jackson, Taharee
Walkoe, Janet

Associate Research Professor
Bishop, M.J.

Research Scientist
Sunderman, Gail

Professor of Practice
Imig, David

Adjunct Assistant Professor
Hyler, Maria
MacDonald, Victoria-Maria

Affiliate Professor
Redish, Edward F.

Affiliate Associate Professor
Benson, Spencer A.
Lavine, Roberta
Neuman, M. Delia

Affiliate Assistant Professor
Silverman, Rebecca

<p**Summer admission is available for the MCERT program ONLY. For information about MCERT, please visit www.education.umd.edu/MCERT.**

Applications for all other master's programs are accepted for the fall or spring.

Information related to our PhD program is now listed under Education: Teaching and Learning, Policy and Leadership (TLPL) in the graduate catalog.

Application Deadlines

Fall:
Doctoral Applications: High Priority: For Best Consideration--November 15th; Priority deadline--January 20. Final deadline March 15 (November 15 preferred) .
Master's Applications must be received by March 15 (January 20 preferred) .
International Students, Final Deadline -- February 1 .
Spring:
EDCI does NOT accept Spring applications for its doctoral program or for the SLEC/TESOL master's/doctoral programs. .
Applications for the master's program must be received by October 1 (September 1 preferred) .
International Students, Final Deadline -- June 1 .
Summer:
Applications for the Maryland Master's Certification Program must be received by February 1 (November 1 preferred) .

Application Requirements

1. **GRE General Scores (Required for the MA program. GRE is NOT required for EDCI M.Ed. programs. Please check the TLPL website for specific requirement)**
2. **Transcript from all previously attended institutions**
3. **3 Letters of recommendation from persons competent to judge the applicant's probable success in graduate school**
4. **Statement of Goals, Experiences, and Research Interests**
5. **Resume**
6. **Scholarly writing sample for MA applicants**

Degree Requirements

Advanced Graduate Specialist Certificate (A.G.S. Certificate)
Please contact the program for more information.

Post-Baccalaureate Certificate in Literacy Coaching (PBC)
The Post-Baccalaureate Certificate in Literacy Coaching is a six week program designed to prepare experienced, highly qualified middle and high school teachers to serve as literacy coaches in low performing middle and high schools. It is a joint program between the University of Maryland (UM)/Baltimore City Public Schools (BCPS City Schools)/Montgomery County Public Schools (MCPS)/Prince George's County Public Schools (PGCPS) serving cohorts of selected middle and high school teachers.

Doctor of Philosophy (Ph.D.)
Students interested in the Department's new Ph.D. program should go to Education: Teaching and Learning, Policy and Leadership (TLPL) in the graduate catalog.

Master of Arts or Master of Education (M.A. or M.Ed.)
Master's degree requirements vary according to the area of concentration and the type of degree. Typically, programs require 30 to 33 credit hours, which includes a core research requirement and possible comprehensive examination. Certification-track M.Ed. programs typically require 42 credit hours.

Visiting Associate Professor
Rolstad, Kellie

Lecturer
Smallwood, Jo Ellen
Zhang, Ying

Clinical Assistant Professor
Baccus, Ayanna
Blejer, Perla
Bote, Lisa
Eaker, Lisa
Fagan, Drew
Fredricks, Daisy
Gutierrez, Rodrigo
Hendricks, Susan
Landa, Melissa
Levin, Dan
Napp Avelli, Carolina
Quintos, Beatriz
Terrell Shockley, Ebony
Travers, Kathleen
Walker, Margaret

Professor Emerita
Finkelstein, Barbara
Oxford, Rebecca L.
Roderick, Jessie A.

Professor Emeritus
Davidson, Neil A.
Fey, James T.
Holliday, William G.
Johnson, Martin L.
Koziol, Stephen
Layman, John W.
Selden, Steven

Associate Professor Emerita
Chambliss, Marilyn J.
Graeber, Anna O.
van Zee, Emily H.

Associate Professor Emeritus
De Lorenzo, William E.
Eley, George, Jr.
Henkelman, James H.
Herschbach, Dennis
Splaine, John
Williams, David

Beyond the successful completion of courses, students must demonstrate high standards of scholarship and the ability to engage in independent research. Students must either write and defend a research thesis, complete a seminar paper (non-thesis option) or a professional portfolio--requirement varies by specialization. Your faculty advisor will help you develop a program of study that is consistent with Departmental and University guidelines.

Facilities and Special Resources

Faculty and students in the department work closely with area schools, colleges, universities, associations and other education-related organizations. Extensive resources in the Washington, D.C., area, including embassies and other international organizations, provide exceptional opportunities for internships and field experiences, research, and materials to enhance formal course experiences. Facilities that support graduate study include the Center for Mathematics Education, the Center for Science and Technology in Education, the Multicultural Research Center, and the Maryland Equity Project. Additional facilities in the College of Education include the Educational Technology Services Center and numerous Professional Development Schools in local schools districts.

Financial Assistance

A variety of sources are available for seeking financial assistance in the way of graduate assistantships, scholarships, fellowships and financial aid loans. For more information visit http://www.education.umd.edu/TLPL/admissions/financiad.html .

Contact Information

For additional information and an admissions overview, please visit http://www.education.umd.edu/TLPL/admissions/overview2.html

**Joy Jones, Coordinator for TLPL Graduate Admissions and Student Services
Room 2311 Benjamin Building
MD 20742-1175
Telephone: (301) 405-3118
Fax: (301) 314-9055
tlpl-grad@umd.edu**

http://www.education.umd.edu/TLPL

Courses:

Related Programs and Campus Units

**Spanish and Portuguese Languages and Literatures
Education: Policy Studies
Joint Space-Science Institute
Education: Teaching and Learning, Policy and Leadership**

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Education: Measurement, Statistics and Evaluation (EDMS)

Faculty:

Professor
Hancock, Gregory R.

Abstract

Measurement, Statistics and Evaluation offers graduate study leading to the Master of Arts or Doctor of Philosophy degrees for students with strong interests in research methods and their applications. Students pursuing Doctoral degrees in other departments may enroll in a dual degree program leading to the Master's degree in Measurement, Statistics and Evaluation, or there is also a 21-credit certificate program for doctoral students. For select undergraduates, there is a five-year Bachelor's/Master's program in Measurement, Statistics and Evaluation.

Admissions Information

In addition to Graduate School requirements, admission decisions are based on the quality of previous undergraduate and graduate work, strength of letters of recommendation from persons competent to judge the applicant's likelihood of success in graduate school, scores on the Graduate Record Examination, and the applicant's statement of academic and career objectives in relation to the program of study to be pursued. Students who seek admission should display strong evidence of aptitude and interest in quantitative methods. Programs of study may be designed to meet the individual needs of both full-time and part-time students since many courses are offered in the late afternoon or evening.

Application Deadlines

Fall:
For financial support, applications must be received by November 15. Final deadline March 15 .
Spring:
Applications must be received by October 1 [limited or no funding available] .
Summer:
Applications for admission starting in the summer may be considered [no funding available] .

Application Requirements

1. GRE General Test
2. Three Letters of Recommendation
3. Statement of Goals and Research Interests
4. Previous College Transcripts
5. TOEFL Scores for Non-native Speakers of English

Degree Requirements

Master of Arts (M.A.)
The Measurement, Statistics and Evaluation M.A. degree program requires a minimum of 30 credit hours. Both thesis and non-thesis options are available. A written comprehensive examination is required for both options and a research paper is required for the non-thesis option. No M.Ed. degree option is currently offered.

Certificate in Measurement, Statistics and Evaluation ()
The Certificate in Measurement, Statistics and Evaluation is designed to provide advanced training in quantitative methods for graduate students majoring in other doctoral programs. The certificate requires a minimum of 21 graduate credit hours. In addition, an advisor must be selected from members of the Measurement, Statistics and Evaluation faculty.

Doctor of Philosophy (Ph.D.)
The Ph.D. program requires both preliminary and comprehensive examinations; the comprehensive examination is designed to assess broad, integrated understanding as well as the student's specialization. A minimum of 30 credit hours, including dissertation credits, must be taken following admission. All students are expected to engage in

Associate Professor
Harring, Jeffrey R.
Jiao, Hong
Stapleton, Laura

Assistant Professor
Sweet, Tracy Morrison
Yang, Ji Seung

Adjunct Associate Professor
Alvestad, Kathryn

University Affiliate
Coulson, Douglas
Fidelman, Carolyn
Kroopnick, Marc
Rupp, Andre
Yumoto, Futoshi

Professor Emeritus
Dayton, C. Mitchell
Lissitz, Robert W.
Macready, George B.
Mislevy, Robert J.
Schafer, William D.

research. Measurement, Statistics and Evaluation does not currently offer the Ed.D. degree.

Facilities and Special Resources

The Department maintains computer equipment with up-to-date statistical software packages. The faculty are actively engaged in a large variety of basic and applied research projects and students are encouraged to become involved in these activities. The Washington and Baltimore areas have numerous organizations that provide opportunities to become involved in projects that have national importance.

Financial Assistance

Graduate teaching assistantships, research assistantships, and fellowships are available. The Department can usually aid students in locating part-time employment opportunities, both on and off campus, as well as providing funding from its own contracts and grants.

Contact Information

For additional information and application procedures, please visit our web site: **www.education.umd.edu/EDMS/**

Jannitta Graham, Graduate Coordinator
3304 Benjamin Building University of Maryland College Park
MD 20742
Telephone: (301) 405-8432
Fax: (301) 405-2891
jgraham7@umd.edu

http://www.education.umd.edu/HDQM

Courses: EDMS

Education: Policy Studies (EDPS)

Abstract

The Department of Education Policy Studies (EDPS) merged with the Department of Curriculum and Instruction (EDCI) to form the Department of Teaching and Learning, Policy and Leadership (TLPL). For more detailed and up-to-date information about programs and resources see the TLPL website at http://education.umd.edu/TLPL.

The programs in Education Policy Studies (EDPS) in the Department of Teaching and Learning, Policy and Leadership promotes critical and discipline-based studies of education policies and practices; encourages thoughtful and responsive explorations of education and related social issues; and fosters innovative and collaborative efforts to inform education policy and leadership at all levels of government.

Graduates pursue professional roles in university teaching and research, fill policy and leadership positions in public and private educational institutions, and work as specialists and advocates in governmental and non-governmental agencies. The Department offers graduate programs of study leading to the M.A.

Faculty bring the disciplines of ecomomics, political science, history, philosophy, sociology, cultural studies, curriculum theory, and organizational leadership to the study of education. They are committed to the preparation of professionals who are able to

Faculty:

Chair
Hultgren, Francine H.

Associate Chair
Croninger, Robert G.

Professor
Malen, Betty L.
Rice, Jennifer K.

Assistant Professor
Ahn, June
Hutt, Ethan

Adjunct Assistant Professor
Davis, Thomas

Professor Emerita
Berman, Louise M.
Finkelstein, Barbara J.

Professor Emeritus
Hawley, Willis D.

apply a range of theories and disciplinary perspectives to the enterprise of education in governmental and non-governmental agencies.

For graduate programs related to Curriculum and Instruction, please see Education: Curriculum and Instruction (EDCI).

NOTE: This section includes information about the M.A. programs previously associated with the Department of Education Policy Studies (EDPS); students interested in these programs should apply to EDPS, though TLPL now sponsors these programs. Students interested in the Department's new Ph.D. program should go to Education: Teaching and Learning, Policy and Leadership (TLPL) in the graduate catalog.

Selden, Steven
Splaine, John E.

Associate Professor Emeritus
Herschbach, Dennis R.

Admissions Information

NOTE: Applicants for the EDPS master's program are accepted for the FALL ONLY.

To be recommended for full admission to a master's program, a minimum undergraduate grade point average of 3.0 is required. Scores on the Graduate Record Examination (verbal, quantitative, writing) should be at the 50th percentile or higher. Because graduate programs are highly competitive, successful applicants often score considerably higher. Students who do not meet one of these requirements, but show other evidence of outstanding potential, may be considered for provisional admission. Admission of qualified applicants is based on their competitive ranking to limit enrollments to available faculty resources. See the description of the EDPS programs on the TLPL website for more detailed information.

Application Deadlines

Fall:
Complete applications, Master's or PhD, must be received by November 15 .
Spring:
Complete applications, Master's only, must be received by June 1 .

Application Requirements

1. GRE General Scores
2. Transcript from all previously attended institutions
3. 3 Letters of Recommendation from persons competent to judge the applicant's probable success in graduate school
4. Statement of Goals, Experiences, and Research Interests
5. Resume
6. Scholarly writing sample

Degree Requirements

Master of Arts (M.A.)
The Department offers the Master of Arts (M.A.) degree. The M.A. degree requires 30 credits beyond a Bachelor's level degree. Beyond the successful completion of courses, students must demonstrate high standards of scholarship and the ability to engage in independent research. Students must either write and defend a research thesis or complete a seminar paper (non-thesis option). Your faculty advisor will help you develop a program of study that is consistent with Departmental and University guidelines.

Doctor of Philosophy (Ph.D.)
Students interested in the Department's new Ph.D. program should go to Education: Teaching and Learning, Policy and Leadership (TLPL) in the graduate catalog.

Facilities and Special Resources

Faculty and students in the department work closely with area schools, colleges, universities, associations and other education-related organizations. Extensive resources in the Washington, D.C., area, including embassies and other international organizations, provide exceptional opportunities for internships and field experiences, research, and materials to enhance formal course experiences. Facilities that support graduate study include the Center for Mathematics Education, the Center for Science and Technology in Education, the Multicultural Research Center, and the Maryland Equity Project. Additional facilities in the College of Education include the Educational Technology Services Center and numerous Professional Development Schools in local schools districts.

Financial Assistance

A variety of sources are available for seeking financial assistance in the way of graduate assistantships, scholarships, fellowships and financial aid loans. For more information visit http://www.education.umd.edu/TLPL/admissions/financiad.html .

Contact Information

For additional information and an admissions overview, please visit http://www.education.umd.edu/TLPL/admissions/overview2.html

Joy Jones, Coordinator for TLPL Graduate Admissions and Student Services
Room 2311 Benjamin Building University of Maryland,
College Park
MD 20742-1175
Telephone: (301) 405-3118
Fax: (301) 314-9055
tlpl-grad@umd.edu

http://www.education.umd.edu/TLPL

Courses:

Related Programs and Campus Units

19th Century Music, Center for Studies in
Education: Curriculum and Instruction
Education: Teaching and Learning, Policy and Leadership

Education: Policy and Leadership (EDPL)

Faculty:

Education Policy and Leadership (EDPL)

Abstract

As of July 1, 2007, the department of Education Policy and Leadership (EDPL) was reorganized into Education Leadership, Higher Education and International Education (EDHI) and Education Policy Studies (EDPS), as described below. The purpose of this reorganization was to provide greater focus and opportunity for each of the two units to fulfill their missions.

During the transition period, while some areas of the two new department sites are still under construction, the archived content of EDPL will remain posted at the EDPL web site location (www.education.umd.edu/EDPL). Once the tranisition is complete, all relevant information should be available at the two new sites:

Education Leadership, Higher Education and International Education (EDHI) will include the following areas of specialization:

- Higher Education
- International Education Policy
- Organizational Leadership and Policy Studies

Education Policy Studies (EDPS) will include the following areas of specialization:

- Curriculum Theory and Development
- Socio-cultural Foundations of Education
- Education Policy

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Education: Certificate of Advanced Study: Measurement, Statistics, and Evaluation (Z904)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Contact Information

Dr. Gregory R. Hancock, EDMS Department Chair
EDMS, Benjamin Building, Room 1230D University of Maryland College Park, MD 20742-1115
MD 20742-1115
Telephone: 301.405.3621
Fax: 301.314.9245
ghancock@umd.edu

http://www.education.umd.edu/EDMS/program/EDMScertificate.htm

Courses:

Education: Certificate of Advanced Study: Special Education (Z905)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Coordinator/Carol Scott
MD 20740
cscott18@umd.edu

http://www.education.umd.edu/CHSE

Courses:

Education: Counseling Psychology, School Psychology, and Counselor Education (EDCP)

Faculty:

Chair
Worthington, Roger L

Graduate Director
Lent, Robert W.

Professor
Fabian, Ellen S.
Hoffman, Mary Ann
Kivlighan, Dennis
Lent, Robert W.
Teglasi-Golubcow, Hedwig
Worthington, Roger L

Associate Professor
Gold, Paul
Miller, Matthew J
Shin, Richard Q

Assistant Professor
O'Neal, Colleen R.
Phillips, Pepper E.
Wang, Cixin

Research Associate Professor
Hutchinson, Jo Ann

Abstract

The graduate program in Counseling Psychology, School Psychology, and Counselor Education (CoPE) includes several distinct areas of specialization that are designed to provide the knowledge and skills needed for practice and scholarship in counseling and related human service professions. These fields are concerned with assisting people individually, in groups, and in organizations to attain their optimal level of personal, social, educational, and career functioning. Graduates are employed in a variety of settings including schools, colleges and universities, mental health agencies, business and industry, government agencies, and other community service and practice facilities. Depending on the specific area of specialization and level of training, program graduates may serve as researchers, educators, supervisors, psychologists, counselors, or program administrators.

Master's level professional entry-level training is offered in the School Counseling program, which prepares students to become school counselors in elementary, middle, and high school settings. School counselors are leaders, advocates, and systemic change agents who provide individual and group counseling to school-aged children, develop and implement comprehensive developmental school counseling programs, and collaborate with all key stakeholders, including classroom teachers, school administrators, parents, and community members, to ensure the academic, personal-social, and college-career development of students.

The Ph.D. degree is offered in two areas of specialization: Counseling Psychology (in collaboration with the Psychology Department) and School Psychology. Doctoral studies

prepare students to achieve exceptional competence in the theory and practice of their field; to develop a high level of skills as researchers, educators and administrators; and to assume positions of leadership in relevant settings. Students in the specialization of Counseling Psychology are prepared to work as researchers, educators, psychologists, and supervisors in such settings as academic departments, college and university counseling centers, and community mental health agencies. Doctoral-level school psychologists serve as researchers, university faculty, supervisors, administrators, and advanced level practitioners. Program accreditation within CoPE includes: The School Psychology and Counseling Psychology doctoral programs are accredited by the American Psychological Association (APA). The School Psychology doctoral program is approved by the National Association of School Psychologists (NASP), and is also approved for certification by the Maryland State Department of Education. The School Counseling masters program is approved by the Maryland State Department of Education.

Note that, since 2012, the CoPE graduate programs have been part of a new department, the Department of Counseling, Higher Education, and Special Education. The CoPE programs were previously housed in the Department of Counseling and Personnel Services.

Research Assistant Professor
Luecking, Debra Martin

Affiliate Assistant Professor
Kirkland-Gordon, Sharon

Clinical Assistant Professor
Berger, Jill
Mitchell, Natasha Ann

University Affiliate
Sedlacek, William

Professor Emeritus
Birk, Janice
Boyd, Vivian S.
Fassinger, Ruth E.
Gottfredson, Gary D.
Greenberg, Kenneth R.
Hershenson, David B.
Marx, George L.
Power, Paul W.
Rosenfield, Sylvia A.
Schlossberg, Nancy
Sedlacek, William
Strein, William O.

Admissions Information

Applicants for regular admission to master's degree programs must have an undergraduate GPA of at least B (3.0 on a 4.0 scale) and must submit their scores on the Graduate Record Examination. Applicants for admission to Ph.D. programs should check specific admissions criteria on the program's website. Applicants' undergraduate programs should ordinarilyy include at least 15 semester hours of coursework in behavioral science fields (e.g., anthropology, education, psychology, sociology, statistics). Selective screening of qualified applicants is necessary in order to limit enrollments to a size that guarantees high quality professional preparation and a close working, professional relationshp between faculty and students.

Application Deadlines

Fall:
For all specialties, applications must be received by December 15 (**December 1 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General required for all programs.
2. 3 Letters of Recommendation
3. Statement of Goals and Professional Interests

See individual program websites for additional information.

Degree Requirements

Doctor of Philosophy (Ph.D.)

Ph.D. students are expected to attain advanced skills as both practitioners and researchers in their area of specialization. All doctoral students are required to take advanced courses in statistics and research design. Because of the highly specialized nature of each of the doctoral programs, applicants should consult the web page for specific areas of specialization. These pages describe specific course and fieldwork requirements, the nature of the comprehensive examination required for completion of the program, and the dissertation requirements.

Master of Arts or Master of Education (M.A. or M.Ed.)

Professional entry-level programs of two types are offered: (1) a Master of Arts (M.A.) degree with thesis, or (2) a Master of Education (M.Ed.) without thesis in School Counseling. Students pursing doctoral degrees may earn the M.A. with thesis within the doctoral program while progressing to the Ph.D. The applicant should consult the web page associated with specific CoPE program areas of specialization for further information concerning the relevant entry-level requirements and curriculum.

Advanced Graduate Specialist Certificate (A.G.S. Certificate)
The A.G.S. certificate is offered in some of the CoPE areas of specialization. For individuals who hold a master's degree in counseling or a closely related field, this certificate program may serve: 1) to provide the additional education required for professional certification or licensure in those specialty areas that require a program of two year's length, and/or 2) to provide the academic background for an advanced level of professional practice within a specialty area. **Those interested in the AGS should contact the program *before* applying**.

Facilities and Special Resources

All master's, A.G.S., and doctoral students are required to include supervised fieldwork experiences in their degree programs. The CoPE programs have excellent cooperative relationships with on-campus facilities, such as the Counseling Center and Health Center. Fieldwork may also be done at a wide variety of school systems, colleges and universities, and counseling services and mental health agencies in the Baltimore/Washington metropolitan area, or nationally.

In addition to campus and program resources, students utilize the many major research and professional institutions that are easily accessible to the campus. These include the Library of Congress, the National Library of Medicine, the National Institutes of Health, the Institute of Education Sciences, professional associations such as the American Counseling Association, the American Psychological Association, and the National Association of School Psychologists.

Financial Assistance

The Department of Counseling, Higher Education, and Special Education offers graduate research, teaching, and administrative assistantships on a selective basis to both masters and doctoral students. The Department also assists its students in finding assistantship placements with a variety of on-campus and off-campus units. In addition, a small number of new Ph.D. students are offered highly selective fellowships funded jointly by the Department and the University.

Contact Information

For additional information and application procedures, please visit our web site: www.education.umd.edu/CHSE/academics/specialization/

Graduate Coordinator: Carol Scott
3214 Benjamin Building
College Park
MD 20742-1125
Telephone: (301) 405-8384
Fax: (301) 405-9995
cope-admissions@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/

Graduate Assistant for Counseling Psychology: Katherine Ross
3214 Benjamin Bldg College Park
MD 20742
klross@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/

Graduate Assistant for School Counseling: Michal Boyars
3214 Benjamin Bldg College Park
MD 20742
mboyars@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/

Graduate Assistant for School Psychology: Meghan Green
MD 20742
schlpsy@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/schoolPsychology.html

Courses: EDCP

Related Programs and Campus Units

Education: Special Education
Higher Education, Student Affairs and International Education Policy
Psychology
Counseling Center, UMCP

Education: Human Development (EDHD)

Abstract

The purposes of the Human Development graduate programs are to contribute to basic knowledge about human development and learning and apply this knowledge in various settings. The general areas of human development covered in courses and research include infant and early childhood development, child development, adolescent development, developmental science, and educational psychology. Specific faculty areas of expertise include achievement motivation, cognitive development, language development, literacy development, peer relationships, teacher-student relationships, moral development, social development, temperament, parenting, developmental neuroscience, civic education, prejudice and discrimination, early childhood policy, and the role of culture on development.

Graduate programs in Human Development lead to the Master of Education, Master of Arts, and Doctor of Philosophy degrees. The research-oriented M. A. (with thesis)and the Ph.D. degree programs in human development are designed to develop studentsscientific knowledge of human development and ability to carry out original research projects. The M.Ed. and M.A. without thesis programs are designed to develop competencies in identifying implications of the scientific knowledge of human development for specific situations and contexts, particularly elementary and secondary schools.

Human Development offers two specialization areas of study at the doctoral level, Educational Psychology, and Developmental Sciences. The graduate programs and specializations prepare graduates for faculty positions at universities or research positions at institutions where research in developmental science and educational psychology is conducted. Graduates of our program have obtained positions as university professors, research scientists, program analysts, and other research-oriented

Faculty:

Chair
Fox, Nathan A.

Director
Battle, Ann Arlene
Corbin, Christy T.
Guha, Mona Leigh

Professor
Alexander, Patricia A.
Cabrera, Natasha J.
Dunbar, Kevin
Fox, Nathan A.
Killen, Melanie A.
Rubin, Kenneth H.
Wang, Min
Wentzel, Kathryn R.
Wigfield, Allan L.

Associate Professor
Bolger, Donald J.
Jones Harden, Brenda P.
Klein, Elisa L.
Marcus, Robert F.
Ramani, Geetha

Assistant Professor
Butler, Lucas
Prather, Richard

occupations including research-oriented professionals in private, policy, or advocacy organizations.

Admissions Information

The College of Education and Graduate School require a minimum GPA of 3.0 (on a 4.0 scale) at the undergraduate level. At the master's level, a minimum GPA of 3.5 is required by the College of Education. The general Graduate Record Exam (GRE) is required by the Department. Three letters of recommendation including evidence of academic potential from university faculty references are required. In addition, students must write a statement of purpose which indicates a match between student research interests and faculty expertise. Students should indicate their research interests, describe any relevant research experience,and how their experience and interests can be met by our program.

Application Deadlines

Fall:
International applications deadlines are December 15 (**November 15 preferred**) .
Domestic application deadlines are March 15 (**December 15 preferred**) .
Spring:
International applications deadline is June 1 .
Masters and doctoral applications may be submitted by October 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Statement of Goals

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Ph.D. degree requires 72 hours of credit which includes 12 dissertation credits. Courses in biological, social, and cognitive development and in intermediate statistics and research methods are required. Students also receive credit for research experiences. Slight modifications of these requirements characterize the Specializations in Educational Psychology and Developmental Sciences. Students are also required to complete a comprehensive examination portfolio prior to advancement to candidacy.

Master of Arts (M.A.)
The M.A. program requires 30 credit hours and offers both a thesis option (24 hours of courses plus 6 hours of thesis) and a non-thesis option (24 hours of courses plus 6 hours of supervised placement in an organization and accompanying papers).Courses in biological, social, cognitive, and personality development and in quantitative methods and a written comprehensive examination are required for all master's degrees.

Master of Education (M.Ed.)
The Master of Education degree in Human Development has the following requirements: Minimum of 30 semesters of coursework, including EDMS 645. A minimum of 15 hours in courses numbered 600-800, with the remainder in the 400 series or above. Required courses focus on biological, social, cognitive, and personality development and in quantitative methods. A written comprehensive examination and seminar paper are required to be taken at the end of the coursework.

Master of Education Off Campus/Outreach Program (M.Ed.)
HDQM offers an off-campus Master of Education in Human Development. This program is run as a cohort model with a new cohort beginning each fall. Courses are held at the Universities of Shady Grove campus in Rockville and online. This 30-Credit, five-semester program focuses on the translation of theory and research on achievement

Associate Research Scholar
Loughlin, Sandra M.

Assistant Research Scientist
Romberg, Alexa

Lecturer
Fox, Emily W.
Hurley, Megan M.
McRae, Angela

Clinical Assistant Professor
Corbin, Christy T.

Professor Emerita
Torney-Purta, Judith

Professor Emeritus
Guthrie, John T.
Hardy, Robert C.

Associate Professor Emeritus
Flatter, Charles H.
Gardner, Albert H.

motivation and child and adolescent social, cognitive, physical and emotional development as those processes influence school achievement and adjustment.

Facilities and Special Resources

The Washington, D.C. area and the University of Maryland are rich in resources for graduate study in human development. The faculty of the Department is multi-disciplinary, representing the broad range of developmental sciences, educational psychology, and related fields. There are programs of funded research, field service programs, and internship experiences available in cooperation with agencies and schools. The Department sponsors the Center for the Study of Children, Relationships, and Culture and manages the on-campus Center for Young Children. Faculty in the department make use of the research facilities at the Maryland Neuroimaging Center and Maryland Language Science Center. Students in the College of Education have access to the latest technology through Educational Technology Services.

Financial Assistance

Students requesting consideration for Financial Aid, in addition to completing the financial aid form found in the Graduate Admissions application, must submit their application by the priority deadline. All students who submit their application by December 1 will automatically be reviewed for any departmental aid. University fellowships, NIH traineeships, and Departmental assistantships are awarded on a competitive basis -- more students are admitted than can be awarded funding. In recent years, only students with undergraduate GPA's of 3.6, GRE scores above the 70th percentile, and strong letters of recommendation from academic references have been successful in obtaining Recruitment Fellowships sponsored by the Graduate School and graduate assistantships in the Department.

First priority for Departmental assistantships goes to students already admitted to the Department who have been assured financial assistance for the full course of their study. Almost all awards of fellowships and assistantships are based on previous academic performance, with little attention to need. In addition, some faculty have external grants which provide support for graduate students. Students who do not receive a fellowship or assistantship from the Department may contact the University Financial Aid office at 301-314-9000 for information about other sources of financial support.

Contact Information

For additional information and application procedures, please visit our web site: www.education.umd.edu/HDQM

Graduate Coordinator, Jannitta Graham
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MD 20742
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Fax: (301) 405-2891
humandev@umd.edu

http://www.education.umd.edu/HDQM

Courses: EDUC EDHD

Related Programs and Campus Units

Neuroscience and Cognitive Science
Hearing and Speech Sciences

Education: Special Education (EDSP)

Abstract

Graduate programs in special education are designed to prepare highly qualified teachers, to provide graduate level content, and to prepare researchers, teacher educators, and leaders in the field of special education. We offer the following graduate program options:

* M.Ed. in Special Education with Elementary/Middle age based certification (MCert 1 Year Program)

* M.Ed. in Special Education with Elementary/Middle age based and Severe Disabilities certification (MCert 2 Year Program)

* M.Ed. in Special Education with severe disabilities certification only (MSDE Special Education generic certification required)

* M.Ed. Noncertification/Specialty Program (30 credits)

* M.A. in Special Education (36 credits)

* Advanced Graduate Specialist Certificate (30 credits beyond the master's degree)

* Ph.D. program

Note that, as of 2012, the EDSP graduate programs are part of a new department, the Department of Counseling, Higher Education, and Special Education. The EDSP degree programs were previously housed in the Department of Special Education.

Admissions Information

For all the M.Ed. programs, students must submit a Basic Skills Test score (found at http://www.education.umd.edu/CHSE/admissions/admission_criteria/Praxis.html) meeting the State of Maryland passing cut score prior to admission into the program and have an undergraduate 3.0 GPA. The Master's of Arts program requires a 3.0 undergraduate GPA and the submission of the Miller Analogies Test or the Graduate Record Examination test scores at or above the 40th percentile rank. The AGS program requires a 3.0 undergraduate GPA, a master's GPA of 3.5, and submission of a score on the MAT, GRE, or Basic Skills Test score (found at: http://www.education.umd.edu/CHSE/admissions/admission_criteria/Praxis.html) meeting the State of Maryland passing cut score prior to admission into the program. Admission to the Ph.D. program requires: 1) Master's degree or equivalent in Special Education or a related field from an accredited institution with a GPA of 3.5 or better; 2) An undergraduate GPA of 3.0 or better; 3) A score on the Graduate Record Exam placing the student at or above the 50th percentile on verbal, quantitative, and analytic subtests; 4) Two years of research or work experience with exceptional populations; 5) Three letters of recommendation from individuals who have direct knowledge of the applicant's academic capabilities, work experience, and professional characteristics; 6) A statement of academic and research goals including intended area of study, research interests, and plans for future employment; 7) Evidence of writing skills shown in the statement of academic and research goals; 8) EDMS Research Methods I or equivalent. Students pursuing teacher certification in special education are required to take courses required by the Maryland State Department of Education which lead to certification in the State of Maryland. Programs for the Master's specialty program, the AGS, and the Ph.D. are planned individually by the students and advisor to reflect each student's background and goals.

Faculty:

Professor
Beckman, Paula J.
Burke, Philip J.
Leone, Peter E.
Lieber, Joan
McLaughlin, Margaret J.
Neubert, Debra Ann

Associate Professor
De La Paz, Susan C.
Kohl, Frances L.
Silverman, Rebecca
Taboada Barber, Ana

Assistant Professor
Cummings, Kelli Dawn
Wexler, Jade

Research Associate
Page-Voth, Leslie V.

University Affiliate
Hebeler, Jean
Mallory, Sarah B.
Moon, Martha Sherril
Speece, Deborah

Professor Emerita
Hebeler, Jean
Moon, Martha Sherril
Speece, Deborah

Application Deadlines for Fall admission: Mar 1 - MEd Certification Programs; International; June 15 - MEd Specialty (Noncertification) Program and AGS; Dec 1 - preferred MA & PhD; final February 1

Application Deadlines

Fall:
Applications must be received by May 1 (**March 1 preferred**) .
Spring:
Applications must be received by October 1 (**September 1 preferred**) .

Application Requirements

1. GRE for PhD; Miller Analogies or GRE for MA; Basic Skills Tests (Praxis Core, SAT, GRE, or ACT at State of Maryland cut score) for MEd Certification Programs; MAT, GRE, or Basic Skills Test for AGS

2. Three Letters of Recommendation

3. Statement of Goals

4. Transcripts from all previously attended colleges and universities

5. Interview required for Ph.D. and M.Ed. Certification Programs

Degree Requirements

Doctor of Philosophy (Ph.D.) (Ph.D.)
The Doctor of Philosophy (PhD) degree in Special Education prepares researchers, teacher educators, and leaders who will advance the education of children and adults with disabilities. The program is intended for full-time students and requires a minimum of 60 post-Master's credits in courses that address special education issues and trends, policies, current research and practice as well as research methods and design. Doctoral students will, with their advisor, identify a sequence of courses and experiences to advance their knowledge in an area of specialization. Students pursuing the doctoral program in special education must have completed a Master of Arts degree or the Master of Education degree in special education or a related area. Students should consult the Department website on Graduate Programs for more information.

Advanced Graduate Specialist Certificate (AGS) (A.G.S.)
The Advanced Graduate Specialist certificate in special education is available to students who wish to take graduate courses beyond the master's degree. The minimum number of graduate hours is 60 (of which no more than 30 credits can be applied from another institution). The core of the program consists of special education courses in addition to other coursework within the university as approved by the student's adviser and the special education graduate faculty. The College of Education awards the certificate.

Master's of Arts (M.A.) (M.A.)
Students enrolled in the master's program in special education may earn the Master of Arts degree which requires a thesis.

Master's of Education Certification (M.Ed.) (M.Ed.)
There are three certification options available: (1) 1 Year Full Time Teacher Certification Program (39-42 credit hours) receiving Elementary/Middle Special Education - Grades 1-8 certification; (2) 2 Year Full Time Teacher Certification Program (45-48 credit hours) receiving Elementary/Middle Special Education (Grades 1-8) AND Severe Disabilities certifications; (3) Severe Disabilities Special Education Certification Program (30 credit hours; full or part time) receiving Severe Disabilities certification.

Master's of Education Noncertification (M.Ed.) (M.Ed.)
The Master's of Education Noncertification/Specialty Program is 30 credit hours (full or part time) provides students an opportunity to develop competence in any area of special education. The student and adviser develop a plan of study that complements the background and career plans of the prospective student with required and elective coursework.

Facilities and Special Resources

The Special Education program provides an unparalleled setting for graduate study. The program's proximity to outstanding public schools in Maryland provides students who wish to pursue teacher certification the chance to gain experience with a culturally and linguistically diverse student population in urban, suburban, and rural settings.

Additionally,, students pursuing a doctoral degree can have experiences in advocacy and professional organizations, government agencies, including the US Department of Education in addition to the coursework they take at the University.

Financial Assistance

A limited number of fellowships, assistantships and/or grants are available to qualified applicants.

Contact Information

For additional information and application procedures, please visit our web site: www.education.umd.edu/EDSP/

Dr. Susan De La Paz
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Department of Counseling, Higher Education, and Special Education University of Maryland College Park,
MD 20742
Telephone: (301) 405-2153
Fax: (301) 405-9995
edspgrad@deans.umd.edu

http://www.education.umd.edu/CHSE/

Courses: EDSP EDSP

Related Programs and Campus Units

Speech-Language Pathology
Education: Counseling Psychology, School Psychology, and Counselor Education

Education: Teaching and Learning, Policy and Leadership (TLPL)

Abstract

The newly approved TLPL Ph.D. program is a reorganization of current, on-campus doctoral programs of study into six related specializations 1) Education Policy and Leadership, 2) Language, Literacy and Social Inquiry, 3) Mathematics and Science

Faculty:

Dean
Wiseman, Donna

Chair
Hultgren, Francine H.

Associate Chair
Croninger, Robert G.

Education, 4) Minority and Urban Education, 5) Teacher Education and Professional Development, and 6) Technology, Learning and Leadership.

These specializations prepare doctoral students to assume a variety of roles, including scholars, researchers, policy analysts, teacher educators, instructional specialists, curriculum developers, teachers, education leaders and advocates. The revision and consolidation of previous areas of study provides students with new opportunities for interdisciplinary study that emphasize scholarship in critical areas of education research, including teacher preparation, STEM fields of education, literacy and language acquisition, education policy and leadership. For more details about this program please visit http://www.education.umd.edu/TLPL/academics/programs.html .

This section includes information about the Ph.D. program sponsored by the Department of Teaching and Learning, Policy and Leadership (TLPL). For information about our master's programs please see information under Education: Curriculum and Instruction (EDCI) and/or Education: Education Policy Studies (EDPS) in the graduate catalog.

Admissions Information

Applications for the Ph.D. program are accepted for the Fall only.

To be recommended for full admission to the TLPL Ph.D. program, a minimum undergraduate grade point average of 3.0 is required. A minimum graduate grade point average of 3.5 is required for applicants who have completed a graduate program. The Graduate Record Exam (GRE) is required of applicants and scores should be at the 50th percentile or higher. Because graduate programs are highly competitive, successful applicants often score considerably higher. Students who do not meet one of these requirements, but show other evidence of outstanding potential, may be considered for provisional admission. Admission of qualified applicants is based on their competitive ranking to limit enrollments to available faculty resources. See the description of the TLPL programs and admissions overview on the TLPL website for more detailed information: http://www.education.umd.edu/TLPL/.

Application Deadlines

Application Requirements

1. **GRE General (minimum score is 50th percentile in each section)**
2. **Transcript from all previously attended institutions**
3. **3 Letters of Recommendation from persons competent to judge the applicant's probable success in graduate school**
4. **Statement of Goals, Experiences, and Research Interests**
5. **Resume**
6. **Scholarly writing sample**

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Ph.D. degree requires a planned sequence of 60 credits beyond a master's degree OR 90 credits beyond a bachelor's degree. In addition to major and elective courses, this includes 6 credits of integrative departmental core, a minimum of 12 credits in intermediate and advanced research methods, 30 credits within the student's specialization and 12 credits of dissertation research. After students have completed most of their course work, the equivalent of 12 hours of comprehensive examination is required prior to advancing to candidacy and approval of the doctoral dissertation committee. The comprehensive exam may take a variety of forms, such as take-home conceptual essays, literature reviews, or research papers. The Doctoral program integrates theory, research, and practice, and students are expected to demonstrate high standards of scholarship

Professor
Afflerbach, Peter P.
Campbell, Patricia F.
Chazan, Daniel
Dreher, Mariam Jean
MacSwan, Jeff
Malen, Betty L.
McGinnis, James R.
Rice, Jennifer K.
Saracho, Olivia N.
Sullivan, Denis F.
Valli, Linda R.
Wiseman, Donna

Associate Professor
Brantinger, Andrew
Clark, Lawrence
Elby, Andy
Ketelhut, Diane Jass
Martin-Beltran, Melinda
McCaleb, Joseph L.
O'Flahavan, John F.
Peercy, Megan
Slater, Wayne H.
Turner, Jennifer

Assistant Professor
Ahn, June
Baccus, Ayanna
Brown, Tara
Clegg, Tamara
Hutt, Ethan
Jackson, Taharee
Silverman, Rebecca
Walkoe, Janet

Associate Research Professor
Bishop, M.J.

Research Scientist
Sunderman, Gail

Professor of Practice
Imig, David

Adjunct Assistant Professor
Davis, Thomas
Hyler, Maria
MacDonald, Victoria-Maria

Affiliate Professor
Redish, Edward F.

Affiliate Associate Professor
Lavine, Roberta

Lecturer
Smallwood, Jo Ellen
Zhang, Ying

Clinical Assistant Professor
Blejer, Perla
Bote, Lisa
Eaker, Lisa
Fagan, Drew
Fredricks, Daisy
Gutierrez, Rodrigo
Hendricks, Susan
Landa, Melissa
Levin, Dan
Napp Avelli, Carolina

and the ability to engage in independent research. Your faculty advisor will help you develop a program of study that will help you fulfill your degree requirements, both coursework and examinations, that is consistent with Departmental and University guidelines. An oral examination in defense of the dissertation is required. It is strongly recommended that prospective doctoral applicants speak with program coordinators and faculty, and visit the Department and classes, to help determine if the Department's programs are appropriate to their academic interests and professional goals.

Master of Arts or Master of Education (M.A OR M.Ed.)
For information about our master's programs please see information under Education: Curriculum and Instruction (EDCI) and/or Education: Education Policy Studies (EDPS) in the graduate catalog.

Facilities and Special Resources

Faculty and students in the department work closely with area schools, colleges, universities, associations and other education-related organizations. Extensive resources in the Washington, D.C., area, including embassies and other international organizations, provide exceptional opportunities for internships and field experiences, research, and materials to enhance formal course experiences. Facilities that support graduate study include the Center for Mathematics Education, the Center for Science and Technology in Education, the Multicultural Research Center, and the Maryland Equity Project. Additional facilities in the College of Education include the Educational Technology Services Center and numerous Professional Development Schools in local schools districts.

Financial Assistance

The Department offers a limited number of graduate assistantships to newly admitted, full-time Ph.D. students each year. In addition to a possible graduate assistantship, TLPL is able to award a very limited number of Graduate School fellowships each year. These fellowships are awarded only to full-time graduate students and may provide tuition support and/or additional living stipends. All Ph.D. applicants who are offered full-time admissions will be considered for an assistantship and fellowship. For best consideration for fellowships, applicants should apply by the December 1st preferred deadline. For more information visit http://www.education.umd.edu/TLPL/admissions/financiad.html .

Contact Information

For additional information and an admissions overview, please visit http://www.education.umd.edu/TLPL/admissions/overview2.html

Joy Jones, Coordinator for TLPL Graduate Admissions and Student Services
Room 2311A Benjamin Building
MD 20742-1175
Telephone: (301)405-3118
Fax: (301)314-9055
tlpl-grad@umd.edu

http://www.education.umd.edu/TLPL

Courses:

Related Programs and Campus Units

Education: Policy Studies
Education: Curriculum and Instruction

Quintos, Beatriz
Terrell Shockley, Ebony
Travers, Kathleen
Walker, Margaret

Professor Emerita
Finkelstein, Barbara
Finkelstein, Barbara J.
Layman, John W.

Professor Emeritus
Davidson, Neil A.
Fey, James T.
Hawley, Willis D.
Holliday, William G.
Johnson, Martin L.
Koziol, Stephen
Selden, Steven

Associate Professor Emerita
Chambliss, Marilyn J.
Graeber, Anna O.
Roderick, Jessie A.
van Zee, Emily H.

Associate Professor Emeritus
De Lorenzo, William E.
Herschbach, Dennis
Herschbach, Dennis R.
Splaine, John

Engineering: Aerospace Engineering (ENAE)

Abstract

The Aerospace Engineering Department offers a broad program in graduate studies leading to the degrees of Master of Science (thesis and non-thesis) and Doctor of Philosophy. Graduate students can choose from the following areas of specialization: aerodynamics and propulsion; structural mechanics and composites; rotorcraft; space systems; and flight dynamics, stability and control. Within these disciplines, the student can tailor programs in areas such as computational fluid dynamics, aeroelasticity, hypersonics, composites, smart structures, finite elements, space propulsion, robotics, and human factors.

Admissions Information

Applicants should have a B.S. degree in Aerospace Engineering (or in a closely related field) with a minimum GPA of 3.2/4.0 from an accredited institution. Applicants with a marginal academic record may be conditionally approved for admission to the M.S. program if other evidence of accomplishment is provided (i.e. publications or exceptional letters of recommendation). Admission to the Ph.D. program requires an academic record indicating promise of the high level of accomplishment required for the degree. The Graduate Record Examination (GRE) is strongly recommended for admission.

Application Deadlines

Fall:
Applications must be received by May 15 (**February 1 preferred**) .
Spring:
Applications must be received by October 31 (**October 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General highly recommended
2. 3 Letters of Recommendation

Degree Requirements

Master of Science (M.S.)

The M.S. degree program offers both a thesis and a non-thesis option. Both options require 30 credits. At least 12 credits are to be in the main discipline. No more than 9 credits may be at the 400 level of which no more than 6 credits may be from department courses. For the thesis option, 6 credits of ENAE 799 (Master's Thesis Research) are required as well as the successful defense of the M.S. thesis. For the non-thesis option, students must write a scholarly paper.

Doctor of Philosophy (Ph.D.)

For the Doctor of Philosophy degree, the department requires a minimum of 36 semester hours of coursework beyond the B.S. which should include: (1) not less than 18 hours within one departmental area of specialization, (2) at least 6 hours from among the other areas of specialization in the Department, and (3) not less than 9 hours in courses that emphasize the physical sciences or mathematics. At least 12 semester hours of credits taken to satisfy (2) and (3) must be 600 level or higher. The student must pass a written qualifying and an oral comprehensive examination and take 12 hours of dissertation credits.

Facilities and Special Resources

Faculty:

Chair
Wereley, Norman M.

Graduate Director
Lee, Sung W.

Professor
Baeder, James D.
Bauchau, Olivier
Celi, Roberto
Chopra, Inderjit
Flatau, Alison
Fourney, William L.
Lee, Sung W.
Lewis, Mark J.
Oran, Elaine S.
Pines, Darryll J.
Schmitz, Fredric H.

Associate Professor
Akin, David L.
Barlow, Jewel B.
Cadou, Christopher
Datta, Anubhav
Martin, Pino
Paley, Derek
Sanner, Robert
Sedwick, Raymond
Winkelmann, Allen E.
Yu, Kenneth H.

Assistant Professor
Hartzell, Christine
Jones, Anya R.
Laurence, Stuart

Research Associate
Carignan, Craig

Research Scientist
Nagaraj, V.T.

Assistant Research Scientist
Choi, Young-Tai
Hu, Wei "Peter"

Affiliate Professor
Trouve, Arnaud

Affiliate Associate Professor
Humbert, J. Sean

Visiting Professor
Hubbard, James

Visiting Assistant Professor
Bowden, Mary L.

Senior Lecturer
Healy, Liam

University Affiliate
Hubbard, James
Hubbard, James
Hubbard, James

The departmental facilities for experimental research include the Glenn L. Martin Wind Tunnel, the Composites Research Laboratory, the Space Systems Laboratory, and the facilities of the Center for Rotorcraft Education and Research. The Glenn L. Martin Wind Tunnel, with its 8-foot high by 11-foot wide test section, has a maximum operating speed of 330 feet per second. It is used extensively for development testing by industry as well as for research. There are also two smaller subsonic tunnels and a supersonic tunnel that are used in support of departmental research programs.

The Composites Research Laboratory is located in the Manufacturing Building. Its facilities include a microprocessor-controlled autoclave, a vacuum hot press, a two-axis filament winding machine, an MTS 220 Kip uniaxial testing machine, an x-ray machine and an environmental conditioning chamber. The laboratory provides for a full spectrum of specimen and component manufacture, preparation and instrumentation, inspection, and testing.

The Space Systems Laboratory performs world-class research on space operations, with particular emphasis on neutral buoyancy simulation of space robotics and human factors. The recently completed Neutral Buoyancy Research Facility is a multi-million dollar laboratory built around a 50-foot diameter by 25-foot deep water tank for simulating the microgravity environment of space. Six different telerobotic systems are currently under test in this facility, which is one of only two operating in the United States and the only neutral buoyancy facility in the world to be located at a university.

The facilities of the Center for Rotorcraft Education and Research include two experimental rotor rigs to test articulated and bearingless rotors in hovering and in forward flight. The hover test facility can accommodate up to a 6-foot diameter rotor. In addition, the facilities include a 10-foot diameter vacuum chamber to study the structural dynamic characteristics of spinning rotors in the absence of aerodynamic loads and a three-component laser Doppler anemometer for flowfield measurements. A new 20-foot by 20-foot by 30-foot anechoic acoustic test chamber is currently under construction for impulsive noise studies of rotorcraft

Financial Assistance

A number of graduate assistantships and fellowships are available for financial assistance. Graduate teaching and research assistantships are available beginning at $20,000 per year plus tuition and health benefits. In addition, a number of fellowships are available, such as Minta Martin Fellowships, Rotorcraft Fellowships, the Hokenson Fellowship, ARCS Fellowships, and various departmental fellowships and scholarships. These fellowships cover tuition in addition to a stipend. All full-time applicants are automatically considered for these fellowships.

Contact Information

For more information, please contact the program.

Tom Hurst, Assistant Director of Graduate Studies

3179 Martin Hall
MD 20742
Telephone: (301) 405-0190
Fax: (301) 314-9001
thurst@umd.edu

http://www.aero.umd.edu

Courses: ENAE

Hubbard, James
Hubbard, James
Xu, Huan

Professor Emeritus
Anderson, John D.
Leishman, John G.

Related Programs and Campus Units

Engineering: Systems Engineering
Engineering: Professional Master of Engineering
Graduate Certificate: Engineering
Applied Mathematics & Statistics, and Scientific Computation

Engineering: Bioengineering (BIOE)

Abstract

The Fischell Department of Bioengineering offers research and education opportunities leading to the Doctor of Philosophy degree and to the MD/MS dual degree program with the University of Maryland School of Medicine. The Bioegineering Graduate Program faculty includes all faculty holding a tenured or tennure-track appointment in the Fischell Department of Bioengineering, as well as faculty holding Affiliate and Adjunct appointments with the Department. The research interests of the program faculty are extensive and include biomaterials, bioMEMS, biomechanics, cardiovascular mechanics, cellular and metabolic engineering, imaging, systems biology, nanobiotechnology, and tissue engineering. Academic departments participating in the program include, but are not limited to: the Fischell Department of Bioengineering, Biology, Cell Biology and Molecular Genetics, Chemistry and Biochemistry, Chemical and Biomolecular Engineering, Computer Science, Electrical and Computer Engineering, Materials Science and Engineering, Mechanical Engineering, and the University of Maryland Schools of Medicine and Pharmacy.

Admissions Information

Admission to the Graduate Program in Bioengineering requires a bachelor of science degree in an engineering discipline from a recognized undergraduate institution. Admission also may be granted to students with a degree in another scientific discipline, such as biology, chemistry, physics, or mathematics. In some cases, students may be required to take undergraduate courses to rectify deficiencies in their background before they will be given permission to enroll in the required core graduate courses. Because of the structure of the first year curriculum, students seldom are admitted to begin the Ph.D. program in the spring semester. In addition, students are rarely admitted that only wish to pursue a master's degree. Therefore, applicants are strongly encouraged to apply for fall admission to the Ph.D. program.

Application Deadlines

Fall:
International Applicant Final Deadline: January 15 (**January 15 preferred**) .
Preferred Deadline (for best consideration for financial aid): December 15 (**December 15 preferred**) .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. Online Application
2. Statement of Goals, Research Interests and Experiences (on-line submission required)
3. 3 Letters of Recommendation (on-line submission required)
4. Complete set of official transcripts reflecting all undergraduate and graduate work completed or in progress
5. Official GRE General Exam score report
6. Official TOEFL score report (if applicable)
7. Maryland In-State Status Form (if wish to apply for Maryland resident status)

Degree Requirements

Faculty:

Associate Dean
Kofinas, Peter

Chair
Fisher, John P.

Associate Chair
Chen, Yu
White, Ian

Distinguished University Professor
Bentley, William E.

Professor
Fisher, John P.
Kofinas, Peter
Payne, Gregory F.
Shapiro, Benjamin
Tao, Yang

Associate Professor
Aranda-Espinoza, Jose Helim
Chen, Yu
Eisenstein, Edward
Herold, Keith E.
Hsieh, Adam H.
Montas, Hubert J.
Muro, Silvia
White, Ian

Assistant Professor
Jay, Steven M.
Jewell, Christopher M.
Matysiak, Silvina
Scarcelli, Giuliano
Stroka, Kimberly

Adjunct Associate Professor
Yu, Yihua Bruce

Affiliate Professor
Al-Sheikhly, Mohamad I.
Baras, John S.
Bruck, Hugh Alan
Bryan, Philip N.
Culver, James N.
DeShong, Philip R.
DeVoe, Donald Lad
Ehrman, Sheryl H.
Fenselau, Catherine C.
Ghodssi, Reza
Kiger, Kenneth T.
Rubloff, Gary W.
Shamma, Shihab
Shirmohammadi, Adel
Sukharev, Sergei I.

Doctor of Medicine / Master of Science (M.D./M.S.)
The Doctor of Medicine / Master of Science (M.D. / M.S.) Program is a dual degree program offered with the University of Maryland School of Medicine. Students applying to the M.D./M.S. Program must first apply to and be admitted to the M.D. program at the School of Medicine, and should indicate their interest in the dual-degree program when applying to the Medical School. The program is organized in the following fashion: 2 years M.D. studies + 1 year M.S. studies + 2 years M.D. studies. The objective of this program is to broaden the educational and research scope of medical doctors in bioengineering. The program should be attractive to those interested in areas including clinical research, biomaterials, biomedical imaging, medical device innovation, medical device development, and drug development. Graduates of the combined program will receive a Doctor of Medicine degree from the University of Maryland School of Medicine as well as a Master of Science degree from the A. James Clark School of Engineering at the University of Maryland, College Park.

Master of Engineering (M.Eng.)
The Professional Master of Engineering (M.Eng.) and Graduate Certificate in Bioengineering, administered by the Office of Advanced Engineering Education, are world-class, flexible educational programs designed to advance technical knowledge and career opportunities for working professionals. The requirements are entirely course-based, and courses are available on-campus and online for full-time or part-time study. To learn more about these programs, please visit the Office of Advanced Engineering Education www.oaee.umd.edu

Doctor of Philosophy (Ph.D.)
The educational approach of the Ph.D. program is to combine the principles and applications embedded in engineering with the sciences of biology, medicine, and health. The motivation for many of the research projects stems from the belief that developments at the interface of biology and engineering will advance the efficacy of health care by developing new paradigms for the diagnosis of disease, and the development and delivery of new therapeutics. Our bioengineering students will gain the knowledge base and skill sets to quantitatively measure, and rationally manipulate cells, tissues, and integrated systems. Bioengineers must bring problem solving skills and design methodologies to the study of biology in an effort to translate the biological sciences into medical practice in an analogous manner to the transformation of chemistry into industrial practice that occurred in the 20th century.

Master of Science (M.S.)
The terminal M.S. degree is intended for students who are interested in expanding their knowledge of bioengineering through research, beyond what is available at the B.S. level. Therefore, the M.S. program involves both coursework and a well-defined research project culminating in a M.S. thesis. The M.S. program may be suitable for top UMD undergraduates engaged in research via an individualized, combined B.S. / M.S. program. A combined M.D. / M.S. program is also available. It should be noted, however, that due to limited resources, the department does not actively recruit students to its M.S. program. Students interested in the M.S. program should contact the Bioengineering Graduate Office prior to submitting an application.

Facilities and Special Resources

The Department has access to well-equipped bioengineering research laboratories and associated departmental facilities of its faculty. In addition, there are core facilities available for bioengineering research. Animal facilities are available if necessary.

Financial Assistance

Graduate assistantships and fellowships are available on a competitive basis to PhD students. No separate financial support application is required. Students will automatically be considered for eligible forms of support.

Affiliate Associate Professor
Desai, Jaydev
Kahn, Jason D.
Lloyd, Isabel K.
Losert, Wolfgang
Raghavan, Srinivasa R.
Shim, Jae Kun
Simon, Jonathan
Wang, Nam Sun

Affiliate Assistant Professor
Dwyer, Daniel
Kanold, Patrick
Karlsson, Amy
Seog, Joonil
Sriram, Ganesh
Upadhyaya, Arpita

Professor Emeritus
Johnson, Arthur T.

Contact Information

Please see the program's web site for program description, admission requirements, and financial aid information.

Graduate Program in Bioengineering
2330 Jeong H. Kim Engineering Building University of Maryland
College Park
MD 20742
Telephone: (301) 405-8268
Fax: (301) 405-9953
bioe-grad@umd.edu

http://www.bioe.umd.edu

Courses: BIOE

Related Programs and Campus Units

Neuroscience and Cognitive Science
Engineering: Materials Science and Engineering
Engineering: Professional Master of Engineering
Graduate Certificate: Engineering
Kinesiology
Biochemistry

Engineering: Chemical Engineering (ENCH)

Abstract

The Chemical and Biomolecular Engineering Department offers educational opportunities leading to a Doctor of Philosophy degree or Masters of Science degree in Chemical Engineering. Both degrees require a written thesis and an oral examination on the thesis. Our faculty research interests cover a wide array of subject matter and is well-equipped for graduate research in; aerosol science and engineering, batteries research, biochemical engineering, protein engineering, computational modeling, fluid mechanics and mixing, fuel cell technology, metabolic engineering and systems biology, nanoparticle technology, polymer processing and characterization, molecular modeling, polymer reaction engineering, thermodynamics and transport phenomena, and systems research. The Department maintains a distributed computing network consisting of research laboratories and a PC laboratory. Major research facilities including electron microscopy, X-ray diffraction, X-ray photoelectron spectroscopy, and NMR are coordinated through a variety of laboratories.

Admissions Information

The programs leading to the Master of Science and Doctor of Philosophy degrees are open to qualified students holding the Bachelor of Science degree. Admission may be granted to students with degrees in other engineering and science areas from accredited programs, and it may be necessary in some cases to require courses to establish an undergraduate Chemical Engineering background. The general regulations of the Graduate School apply in reviewing applications.

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
Applications must be received by June 1 .

Faculty:

Associate Chair
Klauda, Jeffery

Professor
Adomaitis, Raymond A.
Anisimov, Mikhail A.
Calabrese, Richard V.
Choi, Kyu Yong
Ehrman, Sheryl H.
Raghavan, Srinivasa R.
Wachsman, Eric

Associate Professor
Dimitrakopoulos, Panagiotis
Klauda, Jeffery
Sriram, Ganesh
Wang, Nam Sun

Assistant Professor
Karlsson, Amy
Liu, Dongxia
Wang, Chunsheng

Affiliate Professor
Al-Sheikhly, Mohamad I.
Bentley, William E.
DeVoe, Donald Lad
Fisher, John P.
Kofinas, Peter
Zachariah, Michael R.

Affiliate Associate Professor
Jackson, Gregory Scott

Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Completed Application Form
2. Statement of Purpose
3. 3 Letters of Recommendation
4. One complete set of official transcripts reflecting all undergraduate and graduate work completed or in progress
5. Offical GRE Score for General Exam
6. Offical TOEFL Score (if applicable)
7. Application Fee

Degree Requirements

Master of Science or Master of Engineering (M.S. or M.E.)
A minimum of 30 credit hours of course work in technical areas relating directly to chemical engineering is required for the M.S. degree, 6 of which are devoted to thesis research. All students seeking graduate degrees in Chemical Engineering must enroll in ENCH 610, 620, 630, and 640 if they have not completed equivalent courses. In addition to Graduate School regulations, special degree requirements (including core course GPA requiremtns) are described at the Chemical Engineering Department website: www.ench.umd.edu.

Doctor of Philosophy (Ph.D.)
The Doctor of Philosophy degree is granted only upon sufficient evidence of high attainment in scholarship and the ability to engage in independent research. The Chemical Engineering Department requires minimum of 45 semester hours of course work beyond the B.S. degree. A minimum of 18 credit hours of Thesis Research is required; students in the PhD program can register only for ENCH 899 Thesis Research. In addition to Graduate School regulations, special degree requirements include a research aptitude Ph.D. qualifying examination and a research proposal including an oral presentation covering the projected Ph.D. dissertation. All Ph.D. graduate students are required to serve as Teaching Assistants for two semesters. Other requirements, incluidng CORE course GPA requiremtns are found on the Department website: www.ench.umd.edu.

Facilities and Special Resources

A number of special facilities are available for graduate study and research and are coordinated through the Polymer Reaction Engineering Laboratory, the Center for Research on Extreme Batteries, the High Shear Mixing Research Program, the Laboratory of Molecular and Thermodynamic Modeling, the Laboratory for Biochemical Engineering, BioFluid Dynamics Laboratory, Complex Fluids and Nanomaterials Group, Mesothermal Group, the Metabolic Engineering Laboratory, Thin Film Processing Group, and P2OWDER Group. These laboratories contain polymer processing equipment and polymerization reactors, polymer characterization instrumentation, a laser Doppler anemometry facility, an aerosol characterization facility, high performance computational resources, dynamic light scattering, and chemical vapor deposition.

Financial Assistance

Graduate research assistantships typically support qualified Ph.D. students. Graduate fellowships are available on a competitive basis to both entering and continuing Ph.D. students. Typically only those Ph.D. students who enter the program in the Fall semester are eligible for fellowships. We are unable to provide financial support to students in our masters degree program.

Contact Information

Affiliate Assistant Professor
Lee, Sang Bok

University Affiliate
Wang, Chunsheng

Professor Emerita
Greer, Sandra C.

Professor Emeritus
Gentry, James W.
McAvoy, Thomas J.
Regan, Thomas M.
Smith, Theodore G.

For more specific information on the graduate program, contact:

Graduate Coordinator
2113 Chemical and Nuclear Engineering Building
MD 20742
Telephone: (301) 405-5888
Fax: (301)405-0523
enchgrad@deans.umd.edu

http://www.chbe.umd.edu/

Courses: ENCH ENCH

Related Programs and Campus Units

Engineering: Systems Engineering
Engineering: Professional Master of Engineering
Graduate Certificate: Engineering
Applied Mathematics & Statistics, and Scientific Computation

Engineering: Civil and Environmental Engineering (ENCE)

Abstract

The Department of Civil and Environmental Engineering offers graduate courses leading to the Master of Science and Doctor of Philosophy degrees. All programs are planned on an individual basis by the student and an adviser taking into consideration the student's background and special interests. Areas of concentration at both the master's and doctoral levels include: transportation engineering, environmental engineering, water resources engineering, structural engineering, geotechnical engineering, civil systems, and project management.

Admissions Information

Please visit the department's admissions page for further information: http://www.ence.umd.edu/grad/admissions Applicants for admission should hold a B.S. degree in civil engineering. However, applicants with undergraduate degrees in other related disciplines (Mathematics, Sciences, other Engineering, etc.) may be considered with the stipulation that deficiencies in prerequisite undergraduate coursework be corrected before applying or enrolling in graduate courses. In addition to the requirements set forth by the Graduate School, applicants must have a minimum GPA of 3.0 to apply to the Master's Program, and a minimum GPA of 3.5 to apply to the Doctoral Program. Applicants with lower GPA's may be considered and accepted on a provisional basis if other indicators of ability are exceptional (letters of recommendation, GRE scores, prior experience ...). Applicants are also required to submit results from the Graduate Record Examination (GRE).

Application Deadlines

Fall:
FINAL deadline for U.S. Citizens and Permanent Resisdents is May 1 .
PREFERRED: For consideration for financial aid applications must be received by December 1 .
FINAL deadline for Intenational Applicants (even those currently studying in the U.S.) is February 1 .
Spring:
FINAL deadline for U.S. Citizens and Permanent Resisdents is October 15 .
PREFERRED: For consideration for financial aid U.S. Citizen and Permanent Resident applications must be received by September 1 .
FINAL deadline for Intenational Applicants (even those currently studying in the U.S.) is June 1 .

Faculty:

Chair
Schwartz, Charles W.

Professor
Aggour, Mohamed S.
Amde, Amde M.
Aydilek, Ahmet H.
Ayyub, Bilal M.
Baecher, Gregory B.
Chang, Gang-Len
Davis, Allen P.
Goodings, Deborah J.
Haghani, Ali
McCuen, Richard H.
Miller-Hooks, Elise
Schonfeld, Paul M.
Skibniewski, Miroslaw J.
Torrents, Alba

Associate Professor
Austin, Mark A.
Brubaker, Kaye L.
Chang, Peter C.
Clifton, Kelly J.
Cui, Qingbin
Gabriel, Steven A.
Goulias, Dimitrios
Lovell, David J.
Schwartz, Charles W.
Zhang, Lei
Zhang, Yunfeng

Assistant Professor
Cirillo, Cinzia
Forman, Barton
Kjellerup, Birthe
Phillips, Brian

Senior Research Engineer
Cable, John Hart
Link, Ed

Research Professor
Fu, Chung C.

Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Official Transcripts
4. Statement of Purpose
5. CV/Resume

Degree Requirements

Master of Science (M.S.)
The M.S. degree program offers a thesis option and very rarely a non-thesis option. Applicants who do not wish to complete a thesis are encouraged to consider the Professional Master of Engineering (ENPM) degree instead: http://advancedengineering.umd.edu/oaee-graduate-admissions The Department's policies and requirements are the same as those of the Graduate School.

Doctor of Philosophy (Ph.D.)
The requirements for the Ph.D. degree are also the same as those of the Graduate School. The student will work closely with an advisor to develop an approved program of study suited to his or her individual needs. Before admission to candidacy, the student must pass a qualifying examination, which is normally taken after the coursework is at least 75 percent completed.

Facilities and Special Resources

Departmental research facilities include laboratories in the following areas: transportation, systems analysis, environmental engineering, hydraulics, remote sensing, structures, and soil mechanics. Graduate students have convenient access to a spectrum of computer facilities, including networked personal computers and workstations, specialized computer-aided design, graphics, and visualization laboratories, campus mainframe computers, and remote supercomputer facilities.

The Washington and Baltimore metropolitan areas are easily accessible for data, field studies, library access, contacts with national organizations, and attendance at national meetings. The location of the University of Maryland offers a unique opportunity to obtain an advanced degree in civil engineering.

Financial Assistance

Research assistantships may be available from individual faculty members, depending on available resources. Only a limited number of teaching assistantships are available. Part-time work as grading assistants may be available as well.

Contact Information

Graduate Office
Department of Civil and Environmental Engineering, 1173 Glenn L. Martin Hall
University of Maryland
MD 20742
Telephone: (301) 405-4195
Fax: (301) 405-2585
ence-admissions@umd.edu

http://www.ence.umd.edu/grad/admissions

Galloway, Gerald
Milner, Stuart D.
Wright, Richard

Affiliate Professor
Gansler, Jacques S.
Golden, Bruce L.
Kalnay, Eugenia E
Ruth, Matthias

Professor Emeritus
Albrecht, Pedro
Birkner, Francis B.
Carter, Everett C.
Colville, James
Donaldson, Bruce K.
Hao, Oliver J.
Ragan, Robert M.
Schelling, David
Sternberg, Yaron M.
Vannoy, Donald W.
Witczak, Matthew W.

Courses: ENCE ENCE

Related Programs and Campus Units

Engineering: Systems Engineering
Engineering: Professional Master of Engineering
Graduate Certificate: Engineering
Applied Mathematics & Statistics, and Scientific Computation

Engineering: Electrical & Computer Engineering (ENEE)

Abstract

The Department of Electrical and Computer Engineering (ECE) at the University of Maryland, College Park offers one of the strongest and most highly-ranked programs in the nation. Led by 89 full-time and affiliate faculty members and 50 research faculty and postdocs, the research programs of the department cover a wide spectrum of activities in the areas of:

* Communications and Networking
* Signal Processing
* Control, Robotics, and Dynamical Systems
* Computer Engineering
* Optics and Photonics
* Circuits and Systems
* Electronic Materials and Devices
* Bioelectronics and Systems
* Applied Electromagnetics

Our close affiliation with a number of research institutes such as the Institute for Systems Research, the Institute for Advanced Computer Studies, the Institute for Research in Electronics and Applied Physics, the Institute for Physical Science and Technology, and the Maryland Center for Integrated Nano Science and Engineering provides to our students and researchers the opportunity for team-oriented, cross-disciplinary research and access to the institutes' state-of-the-art laboratories.

ECE is a large department that offers a broad range of programs and research opportunities. Its research innovations are aimed at helping government and industry face today's most difficult global challenges. Employers and peer institutions recognize the prestige of Maryland's engineering programs.

Maryland's proximity to Washington, DC, offers unique research opportunities with national and government laboratories such as NASA's Goddard Space Flight Center, the National Institutes of Health, the National Institute of Standards and Technology, and the Army and Navy Research Labs. No other top Engineering program in the U.S. can provide such close proximity and access to national laboratories, federal government, and the Department of Defense.

The Department of Electrical and Computer Engineering offers graduate study leading to the Master of Science and Doctor of Philosophy degrees.

For additional information about the department's programs and research, please visit ece.umd.edu.

Faculty:

Chair
Chellappa, Ramalingam

Associate Chair
Blankenship, Gilmer L.
Gomez, Romel Del Rosario
Srivastava, Ankur

Distinguished University Professor
Ephremides, Anthony
Ott, Edward

Professor
Abed, Eyad
Antonsen, Thomas M., Jr.
Baras, John S.
Barg, Alexander
Bhattacharyya, Shuvra S.
Blankenship, Gilmer L.
Chellappa, Ramalingam
Dagenais, Mario
Davis, Christopher C.
Espy-Wilson, Carol Y.
Ghodssi, Reza
Goldhar, Julius
Goldsman, Neil
Gomez, Romel Del Rosario
Granatstein, Victor L.
Iliadis, Agisilaos
JaJa, Joseph F.
Jacob, Bruce
Krishnaprasad, P.S.
Lawson, Wesley G.
Liu, K.J. Ray
Makowski, Armand M.
Marcus, Steven I.
Mayergoyz, Isaak
Milchberg, Howard M.
Murphy, Thomas E.
Nakajima, Kazuo
Narayan, Prakash
Newcomb, Robert W.
O'Shea, Patrick Gerard
Oruc, Yavuz A.
Qu, Gang
Shamma, Shihab
Shayman, Mark A.
Simon, Jonathan
Srivastava, Ankur
Tits, Andre L.
Ulukus, Sennur
Vishkin, Uzi
Wellstood, Frederick C.
Wu, Min

Associate Professor
Abshire, Pamela
Barua, Rajeev K.

Admissions Information

For the most current and detailed information regarding ECE graduate admissions and deadlines, please refer to our ECE Graduate Admissions web page. Applicants must follow all instructions detailed on this web page.

For admission to the graduate programs in electrical and computer engineering, students must hold an undergraduate degree in electrical or computer engineering or related field (math, computer science, physics, or other areas of engineering) and have an overall grade point average of B+ or better. In exceptional cases, students with a lower GPA may also be admitted. Other criteria include overall academic record, strength of recommendations, GRE score, and adequacy of preparation. Applicants are competitively judged by a faculty committee.

Application Deadlines

Fall:
Financial support consideration deadline is DECEMBER 1. Admission only deadlines are FEBRUARY 1 for international and MAY 1 for U.S. citizens. (**December 1 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Online Application
2. Application Fee
3. GRE General
4. Three Letters of Recommendation
5. Official Transcripts
6. Statement of Purpose
7. TOEFL or IELTS scores for international applicants
8. CV or Resume

Degree Requirements

Doctor of Philosophy (Ph.D.)

Students in the Ph.D. program must complete a course requirement, satisfy a Ph.D. qualifying requirement, pass an oral Ph.D. research proposal examination, and write and successfully defend a Ph.D. dissertation. For complete details, see theECE Graduate Handbook.

Master of Science (M.S.)

The M.S. program offers the thesis and non-thesis options. Students must satisfy a course requirement and complete either a thesis or scholarly paper. For complete details, see the ECE Graduate Handbook.

Facilities and Special Resources

For detailed information on the department's research institutes and laboratories, please see the ECE Research Overview.

Financial Assistance

Financial aid is available to graduate students in the form of research assistantships, teaching assistantships, and fellowships. Details are available in the ECE Graduate Handbook. Applicants for admission are automatically considered for these packages

Franklin, Manoj
Horiuchi, Timothy
La, Richard
Martins, Nuno M. L. C.
Papamarcou, Adrianos
Silio, Charles B., Jr.
Waks, Edo
Yeung, Donald

Assistant Professor
Babadi, Behtash
Dachman-Soled, Dana
Dumitras, Tudor
Hafezi, Mohammad
Khaligh, Alireza
Munday, Jeremy
Pal, Piya
Papamanthou, Charalampos
Rotkowitz, Michael C.

Research Professor
Levine, William S.

Assistant Research Scientist
Kalantari Khandani, Mehdi

Professor of Practice
Kim, Jeong H.

Affiliate Professor
Agrawala, Ashok K.
Aloimonos, John
Anlage, Steven
Bhattacharjee, Samrat
Davis, Larry S.
Desai, Jaydev
Fu, Michael C.
Harris, Andrew I.
Hollingsworth, Jeffrey K.
Lathrop, Daniel P.
O'Leary, Dianne P.
Rubloff, Gary W.
Smela, Elisabeth

Affiliate Associate Professor
Applebaum, Ian
Cukier, Michel
Duraiswami, Ramani
Phaneuf, Raymond J.

Affiliate Assistant Professor
Chen, Yu

University Affiliate
Elaine Shi

Professor Emeritus
Barbe, David F.
Davisson, Lee D.
De Claris, Nicholas
Emad, Fawzi
Harger, Robert O.
Ho, Ping-Tong
Lee, Chi Hsiang
Ligomenides, Panos A.
Melngailis, John
Orloff, Jon H.
Peckerar, Martin C.
Rabin, Herbert
Rhee, Moon-Jhong
Striffler, Charles D.

provided they mark "yes" for financial assistance on the application form and submit their materials by the preferred deadline.

Taylor, Leonard S.
Zaki, Kawthar A.

Associate Professor Emeritus
Pugsley, James H.
Tretter, Steven A.

Contact Information

Graduate Studies Office
Department of Electrical and Computer Engineering
2434 A.V. Williams Bldg.

College Park
MD 20742
Telephone: (301) 405-3681
Fax: (301) 405-8728
ecegradstudies@umd.edu

http://www.ece.umd.edu/

Courses: ENEE

Related Programs and Campus Units

Engineering: Systems Engineering
Engineering: Professional Master of Engineering
Neuroscience and Cognitive Science
Engineering: Telecommunications
Graduate Certificate: Engineering
Applied Mathematics & Statistics, and Scientific Computation

Engineering: Fire Protection Engineering (ENFP)

Abstract

The Department of Fire Protection Engineering (FPE) offers an environment for advanced graduate study and research in the broad area of fire safety. The department offers a Master of Science (M.S) degree and a Master of Engineering (M.Eng.) degree. The mission of the FPE Department is to reduce the burden of fire losses on life and property by providing the highest quality of scientifically-based education, research and outreach in fire protection engineering, and in fire-related safety, health and environmental issues. The FPE graduate program provides the unique interdisciplinary academic foundation and scholarly training needed to address complex engineering problems with emphasis on advancing the field of fire protection engineering.

The educational objectives of the FPE M.S. and M.Eng degree programs are to produce graduates who:

- Have the technical knowledge and skills needed to practice fire protection engineering locally, nationally and internationally in a variety of modern professional settings;

- Have the ability to understand and communicate societal, environmental, economic and safety implications of engineering decisions on the local and global communities;

- Are prepared to participate in the development and promotion of fire protection engineering and assume technical and/or business leadership positions.

Some additional educational objectives specific to the FPE M.S. degree program are to produce graduates who:

Faculty:

Chair
Milke, James A.

Graduate Director
Trouve, Arnaud

Professor
Milke, James A.
Trouve, Arnaud
diMarzo, Marino

Associate Professor
Marshall, Andre W.
Sunderland, Peter B.

Assistant Professor
Gollner, Michael J.
Gollner, Michael J.
Stoliarav, Stanislav I.

Professor Emeritus
Brannigan, Vincent M.
Bryan, John L.
Mowrer, Frederick W.
Quintiere, James G.
Spivak, Steven M.

- Appreciate the importance of scientific research as a mechanism to strengthen the technical basis of fire protection engineering.

- Have the basic competencies needed to pursue advanced studies (e.g., Ph.D.) in fire protection engineering or related fields.

The program is designed to stimulate intellectual growth, increase the level of objective understanding of the physical world and further develop capabilities for analysis and synthesis in order to produce premier fire safety engineers and/or researchers.

Admissions Information

The M.S. and M.Eng. programs are open to qualified students holding a Bachelor of Science (B.S.) degree in engineering, or a related field from an accredited institution. Applicants should have taken the following 4 prerequisite courses: differential equations, fluid mechanics, heat transfer, structural mechanics (or strength of materials). Applicants who have not completed all prerequisites may still be admitted on a provisional basis if they demonstrate satisfactory academic performance in a related field and/or relevant work experience; these applicants may then be asked to complete the prerequisite courses during their first semester at the University of Maryland. In most cases, the application process requires scores from the Graduate Record Examination (GRE).

Application Deadlines

Fall:
Applications must be received by May 31 (**February 1 preferred**) .
Spring:
Applications must be received by October 31 (**September 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. an essay or statement of goals and experiences
2. 3 letters of recommendation
3. official copies of transcripts
4. GRE scores

Degree Requirements

Master of Science or Master of Engineering (M.S. or M.E.)
The Master of Science (M.S.) degree program requires a research thesis and completion of a minimum of 24 credit hours of approved courses. Individual coursework plans are determined by the student, his or her advisor and the department. The M.S. research thesis should make a contribution to the advancement in the state-of-the-art of fire safety science and/or engineering. In addition to a M.S. degree, the department also offers a Master of Engineering (M.Eng.) degree which requires 30 credit hours of approved courses in major and minor core areas. The M.Eng. degree does not include a research thesis. The department's degree requirements are given in detail in its graduate guide, see http://www.fpe.umd.edu/grad.

Facilities and Special Resources

See http://www.fpe.umd.edu/research/labs for a description of the experimental and computer laboratories available in the Department of Fire Protection Engineering.

Financial Assistance

The department of Fire Protection Engineering offers several types of financial support through various research or partial or full teaching assistantships. Students are also

encouraged to seek other external funding opportunities, for instance via University of Maryland work-study programs and internships available in fire laboratories and FPE consulting companies in the Baltimore-Washington area. For more details, see the department's graduate guide available athttp://www.fpe.umd.edu/grad.

Contact Information

Further information is readily available via our FPE web site at http://www.fpe.umd.edu.

Arnaud Trouve, Professor and Director of Graduate Studies
3104D J.M. Patterson Bldg.-
Fire Protection Engineering Department - University of Maryland - College Park
MD 20742
Telephone: (301) 405-8209
Fax: (301) 405-9383
enfpgrad@deans.umd.edu

http://www.fpe.umd.edu/

Courses: ENFP

Related Programs and Campus Units

Engineering: Professional Master of Engineering
Graduate Certificate: Engineering

Engineering: Materials Science and Engineering (ENMA)

Abstract

Materials Science and Engineering is an interdisciplinary program. Students from engineering and science disciplines receive a solid foundation in the physics and chemistry of materials, thermodynamics and structure of materials, as well as the latest technological aspects of materials in today's manufacturing environment. Faculty research areas are mainly concentrated in the development of novel materials for today's electronics, energy, biomedical and high tech industries. These materials may be bulk or thin film format and range from ceramics, semiconductors, metals, polymer and biomaterials . Departmental faculty members are major participants in the University of Maryland Materials Research Science and Engineering Center, the Maryland NanoCenter and the University of Maryland Energy Research Center. For an overview of the Materials Science and Engineering Department, please visit Materials Science and Engineering at the University of Maryland.

Admissions Information

The Department offers graduate study leading to the Master of Science (thesis or non-thesis options) and Doctor of Philosophy degrees. In addition, students enrolled in the Professional Master of Engineering program may choose Materials Science and Engineering as a program option. Graduate study is open to qualified students holding a bachelor's degree from accredited programs in any of the engineering and science areas. For detailed admissions and program information, please visit Materials Science and Engineering Graduate Programs.

Application Deadlines

Fall:
Applications must be received by January 15 .

Faculty:

Acting Chair
Phaneuf, Raymond J.

Graduate Director
Takeuchi, Ichiro

Professor
Al-Sheikhly, Mohamad I.
Ankem, Sreeramamurthy
Briber, Robert M.
Christou, Aristos
Oehrlein, Gottlieb
Phaneuf, Raymond J.
Roytburd, Alexander
Rubloff, Gary W.
Salamanca-Riba, Lourdes G.
Takeuchi, Ichiro
Wachsman, Eric
Wuttig, Manfred R.

Associate Professor
Cumings, John
Lloyd, Isabel K.
Martinez-Miranda, Luz
Rabin, Oded

Assistant Professor
Hu, Liangbing
Leite, Marina Soares
Mo, Yifei

Adjunct Professor
Barkatt, Arron
Kukla ,Maija M.

Spring:
Applications must be received by June 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Statement of Research Interests
4. CV

Degree Requirements

Master of Science (M.S.)

The M.S. degree program offers thesis and non-thesis options. The thesis option requires 24 credit hours of course work plus a thesis. The non-thesis option requires 30 credit hours of course work and a scholarly research paper. All students must complete the Program Core requirements as well as all Graduate School requirements.

The University of Maryland's Office of Advanced Engineering Education also offers a Professional Master of Engineering (M.Eng.) degree with a materials science and engineering option which requires 30 credits of graduate coursework and does not require a thesis.

Doctor of Philosophy (Ph.D.)

Students wishing to pursue a Ph.D. must complete 45 credits of core and specialized coursework and a dissertation based on original research. After the completion of the second semester of coursework, the student will take the Ph.D. qualifying examination. Advancement to candidacy occurs after the completion of the core courses with a minimum of 2 grades of A- or higher and 2 grades of B- or higher and the successful completion of the qualifying examination.

Facilities and Special Resources

Special equipment includes scanning and transmission electron microscopes; X-ray diffraction devices; image analysis and mechanical testing facilities; crystal growing, thin film deposition and analysis equipment; HPLC, GC, IR and other sample preparation and analytical apparatus.

The Laboratory for Advanced Materials Processing (LAMP) in JM Patterson 2225 includes a class 1000 clean room for various kinds of thin film processing, particularly things difficult to acccomplish in the NanoCenter's new FabLab clean room in the Kim Building. LAMP also features custom-designed ultraclean chemical vapor deposition (CVD) and atomic layer deposition (ALD) equipment as the basis for research in nano applications and manufacturing process prototyping, particularly with real-time chemical sensing for metrology and process control. A custom wafer-scanning electrical characterization facility enables resistance and capacitance mapping.

The Nano-Bio Systems Laboratory (NBSL) in JM Patterson 2229 adjoins LAMP and provides capability for biotech research, specifically in biomaterials processing and biomicrosystems development. It includes a Zeiss 310 laser confocal/fluorescence microscope, microfluidic chip testing for biomolecular reaction and cellular response experiments, biomaterials deposition, a Zyvex L200 nanomanipulator system for life science studies, and mass spectrometry and ICP optical emission equipment.

The W. M. Keck Laboratory for Combinatorial Nanosynthesis and Multiscale Characterization in 1141 Kim Building houses several thin film deposition chambers for

Livingston, Richard A .
Rush, J. Jack

Affiliate Professor
Barkatt, Arron
Eichhorn, Bryan W.
Flatau, Alison
Ghodssi, Reza
Kofinas, Peter
Kukla ,Maija M.
Livingston, Richard A .
Rush, J. Jack
Shapiro, Benjamin
Sita, Lawrence R.
Smela, Elisabeth
Zachariah, Michael R.

Affiliate Associate Professor
Aranda-Espinoza, Jose Helim
Lee, Sang Bok
Ouyang, Min
Wang, Chunsheng

Affiliate Assistant Professor
Cui, Jun
Nie, Zhihong

University Affiliate
Bartolo, Robert
Cook, Robert
Foecke, Timothy
Hammouda, Boualem
Pate, Brian D.
Slutsker, Julia
Talin, Albert

Professor Emeritus
Arsenault, Richard J.
Silverman, Joseph

rapid exploration of novel functional materials. The combinatorial approach allows simultaneous invstigation of large numbers of different samples. The combinatorial laser molecular beam epitaxy is used to perfrom atomic layer controlled combinatorial synthesis of functional materials. Atomically controlled growth of unitcells are monitored in-situ using electron diffraction.

The Nanoscale Imaging, Spectroscopy and Properties (NISP) lab, located in the Jeong H. Kim Building, houses the most electron powerful microscopes within any university in the Washington, DC metro area. The facility has a Field-emission Transmission Electron Microscope (TEM) with 1.4 angstrom resolution and can generate chemical-composition maps of materials using Energy-Dispersive X-Ray Spectroscopy (EDS) or Electron Energy-Loss Spectroscopy (EELS). Also housed in the lab are a thermionic TEM with 2.0 angstrom resolution (capable of in-situ electrical measurements and in-situ observations between -183 C and 1000C) and an electron microprobe with five Wavelength-Dispersion X-Ray Spectrometers (WDS).

Equipment available at other facilities include a Lakeshore vibrating scanning magnetometer and a scanning Auger spectrometer.

For additional information about the department's research facilities, please visit the following webpage: Materials Science and Engineering Research.

Financial Assistance

Financial assistance in the form of teaching and research assistantships and sponsored fellowships are available to qualified students. Requests for financial assistance will be considered for Fall admission only.

Contact Information

Information is available from:

Dr. Kathleen C. Hart, Associate Director, Student Services
1111 Chemical and Nuclear Engineering Bldg.
MD 20742
Telephone: (301) 405-5989
msegrad@umd.edu

http://www.mse.umd.edu/grad/index.html

Courses:

Related Programs and Campus Units

Engineering: Systems Engineering
Engineering: Professional Master of Engineering
Engineering: Bioengineering
Biophysics
Graduate Certificate: Engineering

Engineering: Mechanical Engineering (ENME)

Faculty:

Chair
Balachandran, Balakumar

Abstract

The Department of Mechanical Engineering offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. In addition, students may pursue a Master of Engineering degree through the Professional Master's Program of the Office of Advanced Engineering Education. The Department's instruction and research are carried

out through the following four divisions: i) Design and Reliability of Systems; ii) Electronic Products and Systems; iii) Mechanics and Materials; and iv) Thermal, Fluids and Energy Sciences.

Design and Reliability of Systems (Formerly known as Design, Risk Assessment and Manufacturing) - The focus of this area of concentration is the study of: Product and process design and decision making; Manufacturing system modeling and automation; Manufacturing process modeling and control; Reliability and failure modes associated with specific semiconductor devices; Manufacturing technology designed specifically to meet high standards for yield and quality; Reliability test methods for various electronic or mechanical devices; Test screening of parts or systems to eliminate latent defects; Reliability and safety assessment tools for complex aerospace, nuclear, or chemical process systems.

Electronic Products and Systems - This area of concentration addresses the fundamental methods to attain more cost-effective and reliable electronic packaging. Areas of specialization include: Electronic packaging; Materials characterization; Acceleration testing; Condition monitoring; Computer aided life cycle engineering (CALCE).

Mechanics and Materials - This division concentrates on the study of analytical and experimental fundamentals of mechanics and materials. Areas of specialization include: Computational modeling; Control systems; Design, characterization, and manufacturing of materials; Elasticity; Experimental mechanics; Fracture mechanics; Linear and nonlinear mechanics; Micro-nano-bio systems; Noise and vibration control; Nonlinear dynamics; Robotics and intelligent machines; Smart structures.

Thermal, Fluids and Energy Sciences - This division encompasses two broad disciplines: thermal science and fluid mechanics. Areas of specialization include: Heat transfer; Combustion; Energy systems analysis; Hydrodynamics; Turbulence; Computational fluid dynamics (CFD).

Reliability and Risk Engineering - This program covers aspects of engineering related to reliability and risk assessment. The primary areas of specialization include: Microelectronic reliability; Reliability analysis; Risk analysis; Software reliability.

Admissions Information

The programs leading to the M.S. and Ph.D. degrees are open to qualified students holding a bachelor's degree in mechanical engineering. Admission may also be granted to students with degrees from other areas of engineering, mathematics, and physical sciences. In some cases, students may be required to take undergraduate courses to fill gaps in their background. In addition to the requirements set forth by the Graduate School, the applicant is required to submit scores from the Graduate Record Examination (GRE) and, for all international applicants, scores from the TOEFL exam are also required. Applicants are also required to submit at least three letters of recommendation and a statement of purpose.

Application Deadlines

Fall:
US Applications must be received by May 15 (**January 7 preferred**) .
International Applications must be received by February 1 (**January 7 preferred**) .
Spring:
US Applications must be received by October 1 (**August 15 preferred**) .
International Applications must be received by June 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Associate Chair
Bruck, Hugh A.
Sandborn, Peter A.

Distinguished University Professor
Gupta, Ashwani K.

Professor
Azarm, Shapour
Balachandran, Balakumar
Bar-Cohen, Avram
Baz, Amr M.
Bernard, Peter S.
Bruck, Hugh A.
Christou, Aristos
Dasgupta, Abhijit
DeVoe, Donald Lad
Desai, Jaydev
Duncan, James H.
Gabriel, Steven A.
Han, Bongtae
Herrmann, Jeffrey W.
Kiger, Kenneth T.
Kim, Jungho
McCluskey, F.P.
Modarres, Mohammad
Ohadi, Michael M.
Pecht, Michael G.
Radermacher, Reinhard K.
Sandborn, Peter A.
Smela, Elisabeth
Srebric, Jelena
Yang, Bao
diMarzo, Marino

Regents Professor
Gupta, Satyandra K.
Mote, Clayton D., Jr.

Associate Professor
Bergbreiter, Sarah
Bigio, David I.
Chopra, Nikhil
Chung, Peter
Cukier, Michel
Li, Teng
Pertmer, Gary A.
Schmidt, Linda C.
Yu, Miao
Zhang, Guangming

Assistant Professor
Fuge, Mark
Hahn, Jin-Oh
Larsson, Johan
Riaz, Amir
Sochol, Ryan
Vaughn-Cooke, Monifa

Associate Research Professor
Aute, Vikrant C.
Hwang, Yunho
Liu, Xinan

Associate Research Scientist
Dessiatoun, Serguei
Shooshtari, Amir H.

Assistant Research Professor
Ling, Jiazhen

The minimum requirements of the Department of Mechanical Engineering for acceptance into the Graduate program are:

1. Bachelor's degree from regionally accredited college or university (or equivalent from a foreign institution).
2. At least a 3.0 G.P.A. (on a 4.0 scale).
3. At least 3 letters of recommendation strongly supporting the applicant's admission into the Graduate Program.
4. An essay or statement of goals and experiences.
5. A score greater than 163 on the Quantitative section and greater than 4.5 on the Analytical Writing section of the GRE General Test.
6. International applicants: at least a 577 (paper-based) or 100 (Internet-based) score on the TOEFL exam.

Degree Requirements

Doctor of Philosophy (Reliability Engineering) (Ph.D)
Students in the Ph.D. program must take a minimum of 36 credits of approved graduate coursework beyond the B.S. degree (a minimum of 12 credits of coursework at the University of Maryland) and 12 credits of dissertation research. Students currently holding an M.S. from an approved engineering, math, or science program may apply up to 24 credits from their previous degree towards their doctoral coursework requirement. In addition, students must pass a qualifying examination, propose and have an approved Ph.D. dissertation topic (within two semesters of passing the qualifying exam), and successfully produce and defend a Ph.D. dissertation on an original research topic. (See http://www.enme.umd.edu/grad/phd-req.html for details)

Doctor of Philosophy (Mechanical Engineering) (Ph.D.)
Students in the Ph.D. program must take a minimum of 36 credits of approved graduate coursework beyond the B.S. degree (a minimum of 12 credits of coursework at the University of Maryland) and 12 credits of dissertation research. Students currently holding an M.S. from an approved engineering, math, or science program may apply up to 24 credits from their previous degree towards their doctoral coursework requirement. In addition, students must pass a qualifying examination, propose and have approved a Ph.D. dissertation topic (within two semesters of passing the qualifying exam), and successfully produce and defend a Ph.D. dissertation on an original research topic. (See http://www.enre.umd.edu/grad/phd-req.html for details)

Master of Science (Mechanical Engineering) (M.S.)
Students enrolled in the M.S. program in Mechanical Engineering must complete at least 30 credits for graduation. This includes 24 credits of approved coursework and 6 credits of M.S. Thesis Research. The M.S. Coursework Plan sets forth the courses required to be taken by the student in partial fulfillment of the M.S. degree requirements. The coursework plan must be prepared in consultation with a faculty advisor in the student's technical area of interest, and submitted to the Graduate Office (2180 Glenn L. Martin Hall) for approval by the Director of Graduate Studies at the beginning of the first semester of study. Changes to the plan are permitted, but must be approved by the student's advisor and the Director of Graduate Studies prior to their implementation. A new coursework plan reflecting the changes must be filed with the ME Graduate Office every time changes are made.

Master of Science (Reliability Engineering) (M.S.)
Two options exist to earn the M.S. degree in Reliability Engineering:
Non-thesis option
Complete 30 credits with at least 18 at the 600-level or above. Complete the required 6 credits of core courses (see below). Maintain an average grade of B or better. Submit at least one scholarly paper addressing reliability within his/her field of engineering for approval by two faculty members. The topic must be selected and an advisor located by the second semester of study. The paper can be completed by registering for ENRE648, an independent study course with selected advisor and approved through Graduate Committee. Complete a set of approved technical elective courses to satisfy the balance of the course requirements (a minimum of 24 credits).
Thesis option
Complete 24 credits with at least 12 at the 600-level or above. Complete the required 6

Assistant Research Scientist
Azarian, Michael
Choo, Kyosung

Professor of Practice
Firebaugh, Millard S.
Fischell, Robert E.
Kim, Jeong H.

Affiliate Professor
Kalnay, Eugenia E
Nau, Dana S.
Oran, Elaine S.
Quintiere, James G.
Riley, Donald R.
Sunderland, Peter B.
Trouve, Arnaud
Zachariah, Michael R.

Affiliate Associate Professor
Marshall, Andre W.

Affiliate Assistant Professor
Gollner, Michael J.
Hu, Liangbing
Stoliarov, Stanislav I.

Visiting Professor
Semerjian, Hratch G.
Short, James

University Affiliate
Osterman, Michael
Severinsky, Alex

Distinguished University Professor Emeritus
Sengers, Jan V.

Professor Emeritus
Anand, Davinder K.
Armstrong, Ronald W.
Berger, Bruce S.
Buckley Jr., Frank T.
Cunniff, Patrick F.
Dally, James W.
Dieter, George E., Jr.
Holloway, David C.
Kirk, James A.
Magrab, Edward B.
Marks, Colin H.
Mosleh, Ali
Piomelli, Ugo
Roush, Marvin
Sanford, R.J.
Sayre, Clifford
Wallace, James M.
Walston, William H., Jr.
Yang, Jackson C.S.

credits of core courses. Maintain an average grade of B or better. Take an additional 6 credits of ENRE 799 (thesis research). Write a satisfactory thesis and defend the thesis in an oral examination. Complete a set of approved technical elective courses to satisfy the balance of the course requirements (a minimum of 18 credits).
(See http://www.enme.umd.edu/grad/ms-req-reliability.html#courseReq for details)

Facilities and Special Resources

The department and college of engineering provide access to a wide variety of experimental and computing facilities. Selected department computer resources include approximately 100 networked PC systems and 100 UNIX workstations. In addition, an enriched CAD computing environment is provided through a large number of third-party software products, including computer aided design applications.

Financial Assistance

Financial assistance is available to highly qualified students in the form of research and teaching assistantships. The most outstanding applicants are offered fellowships. Students seeking financial assistance should submit with their applications a current resume or CV as well as a statement regarding their qualifications and/or past research or teaching experience. Financial assistance is sought for all worthy students. For example, the following fellowships are available for incoming Ph.D students; Dean's Fellowships (supplements Teaching Assistantships and Research Assistantships (managed by the A. James Clark School of Engineering); University Fellowships administered by the Graduate School (supplements Teaching Assistantships and Research Assistantships); and LSAMP Bridge to the Doctorate Fellowship. Current graduate students may also apply to the Clark School's Future Faculty Fellows Program; Dissertation Fellowship from the Graduate School; Litton Fellowship (ME & ECE); and other internally awarded and administered fellowships and scholarships. Assistance is also available in identifying and applying for prestigious external fellowships. ARCS Fellowship.

Contact Information

Detailed information regarding our graduate programs may be found on our website.

Associate Director of Graduate Studies/Kerri Poppler James
Department of Mechanical Engineering College Park
2178 Glenn L. Martin Hall
College Park, MD 20740
Telephone: 301-405-8601
Fax: 301-405-8015
kjames3@umd.edu

http://www.enme.umd.edu/grad/

Coordinator of Graduate Studies/Tameka Boggs
Department of Mechanical Engineering

2180 Glenn L. Martin Hall
College Park, MD 20742
Telephone: (301) 405-4216
Fax: (301) 314-8015
http://www.enme.umd.edu/grad/

Associate Chair and Director of Graduate Studies/Prof. Hugh A. Bruck
Department of Mechanical Engineering

2174 Glenn L. Martin Hall
College Park, MD 20742

Telephone: 301-405-8711
Fax: 301-314-9477
bruck@umd.edu

http://www.enme.umd.edu/grad

Director of Reliability Engineering Graduate Program/Prof. Mohammad Modarres
Department of Mechanical Engineering

0151 Glenn L. Martin Hall
College Park, MD 20742
Telephone: (301) 405-5226
Fax: (301) 314-9601
modarres@umd.edu

http://www.enre.umd.edu/

Courses: ENME ENRE

Related Programs and Campus Units

Engineering: Systems Engineering
Engineering: Professional Master of Engineering
Graduate Certificate: Engineering
Applied Mathematics & Statistics, and Scientific Computation

Engineering: Professional Master of Engineering (ENPM)

Abstract

The Professional Master of Engineering program is a practice-oriented graduate program designed to assist engineers and technical professionals in the development of their careers and to provide the expertise needed in the rapidly changing business, government, and industrial environments. Late afternoon, evening, and 100% online classes are taught by the College Park faculty and experienced adjunct faculty at the College Park campus and designated learning centers in Maryland. PLEASE NOTE: DO NOT use program code ENPM when applying for this program. Please use the codes for each academic option listed below.

Options are available in the following engineering disciplines:

Aerospace Engineering (PMAE)

Bioengineering* (PMBI on campus, MEBI online)

Chemical and Biomolecular Engineering (PMCH)

Civil and Environmental Engineering (PMCE)

Cybersecurity* (PMCY on campus, MECY online)

Electrical and Computer Engineering (PMEE)

Energetic Concepts* (MEEC online only)

Faculty:

Executive Director
Syrmos, George

Advisor
Bergbreiter, Sarah
Briber, Robert M.
Bruck, Hugh A.
Chung, Peter
Cukier, Michel
Fourney, William L.
Haghani, Ali
Herold, Keith E.
Kalantari Khandani, Mehdi
Klauda, Jeffery
Memon, Atif M.
Milke, James A.
Qu, Gang
Takeuchi, Ichiro
Trouve, Arnaud
Vaughn-Cooke, Monifa

Environmental Engineering (PMEN)

Fire Protection Engineering* (PMFP on campus, ENGF online)

Materials Science and Engineering (PMMS)

Mechanical Engineering (PMME)

Nuclear Engineering* (MENU online only)

Project Management* (PMPM on campus, MEPM online)

Reliability Engineering* (PMRE on campus, MERE online)

Robotics (PMRO)

Software Engineering (PMES)

Sustainable Energy Engineering* (PMSU on campus, MEEE online)

Systems Engineering (PMSE)

Transportation Systems* (METS online)

* available 100% online

Admissions Information

The program is open to qualified applicants holding a regionally accredited baccalaureate degree in engineering or a related field.

Applicants with an undergraduate GPA of less than 3.0 may be admitted on a provisional basis if they have demonstrated satisfactory performance in another graduate program and/or their work has been salutary.

Applicants with foreign credentials must submit academic records in the original language with literal English translations. Allow at least three months for evaluation of foreign credentials.

Applicants are advised to review the Graduate School English requirements to learn whether or not the submission of TOEFL or IELTS scores is required.

We trust that you will find this 30 credit-hour program to be an affordable, convenient way to earn an engineering graduate degree, to "retool" and keep current with the latest technological developments in your field, or perhaps to develop a new area of expertise so as to further your career.

Please note that, in addition to the application semesters and deadlines listed below, Winter applications are accepted for ENGF APPLICANTS ONLY. For these applicants, the Winter domestic deadline is November 1st and the Winter international deadline is May 1.

Application Deadlines

Fall:
International applications must be received by February 1 .
Domestic applications must be received by August 15 (**August 1 preferred**) .
Spring:
International applications must be received by June 1 .
Domestic applications must be received by January 10 (**December 15 preferred**) .
Summer:
Unfortunately, we cannot accept international applications for summer admission .
Domestic applications must be received by May 15 (**May 1 preferred**) .

Application Requirements

1. Bachelor's degree in engineering or a related field
2. GRE not required
3. College Transcripts
4. 3 Letters of Recommendation
5. Graduate School admission application and fee
6. In online application, select the appropariate program option as the major from the list above

Degree Requirements

Master of Engineering (M.Eng.)
The student chooses an area of concentration offered by an engineering department and completes 30 credit hours of approved coursework with a cumulative GPA of 3.0 or above. The coursework, which allows up to 12 credits at the 400-level, must be approved by the program's departmental faculty advisor.

Facilities and Special Resources

Courses in the Professional Master of Engineering program are currently offered on the College Park campus, at off-campus centers via video-teleconferencing, and 100% online. The Clark School of Engineering's Distance Education Technology and Services (DETS) office administers a live interactive distance education system and webcast course capture for students to take courses as they are happening or at a time convenient for their schedule. Remote sites around the State of Maryland where our courses can be taken live via DETS are at the Universities at Shady Grove in Montgomery County, the University Center of Northeastern Maryland in Harford County, and the Southern Maryland Higher Education Center in St. Mary's County. In addition to lecture dissemination, DETS provides state-of-the-art chat, bulletin board, video chat, group presentation, and discussion technologies that give our distance students the same, if not more access to faculty and their fellow students.

The Clark School's Engineering Information Technology group also provides access to needed software and computer resources through dedicated virtual computer terminals that allow distance students full access to licensed software, libraries, databases, and specialized programs.

Financial Assistance

There are no assistantships or fellowships available in this program.

Contact Information

For more specific information, contact:

Dr. George Syrmos, Executive Director
2105 J. M. Patterson Building, University of Maryland, College Park
MD 20742
Telephone: (301) 405-0362
Fax: (301) 405-3305
oaee@umd.edu

http://www.oaee.umd.edu

Ms. Vinette Brown-Darlington, Assistant Director for Academic Outreach
For Questions about Admissions and Academic Programs
2105 J. M. Patterson Building, University of Maryland, College Park
MD 20742
Telephone: (301) 405-1098
Fax: (301) 405-3305
oaee@umd.edu

http://www.oaee.umd.edu

Courses: ENPM

Related Programs and Campus Units

Engineering: Aerospace Engineering
Engineering: Chemical Engineering
Engineering: Civil and Environmental Engineering
Engineering: Electrical & Computer Engineering
Engineering: Fire Protection Engineering
Engineering: Materials Science and Engineering
Engineering: Mechanical Engineering
Engineering: Reliability Engineering
Engineering: Systems Engineering
Engineering: Bioengineering

Engineering: Reliability Engineering (ENRE)

Abstract

Reliability Engineering is an interdisciplinary program of the Department of Mechanical Engineering. The academic and research programs are based upon the recognition that the performance of a complex system is affected by engineering inputs that begin at conception and extend throughout its lifetime. Students may specialize in Assessment (Root-Cause Failure Analysis, Probabilistic Risk Assessment, Common-Cause Failures); Testing and Operation (Operator Advisory Systems, Human Reliability, Software Reliability); Manufacturing (Statistical Process Control, Improved Manufacturing Methods); Component and Structures Reliability (Microelectronics and Materials); or Electronic Packaging Reliability.

Admissions Information

The Program offers graduate study leading to the Master of Science, Professional Master of Engineering (offered through the Office of Advanced Engineering Education), and Doctor of Philosophy degrees and is open to students who have a Bachelor of Science degree in engineering, physics, or mathematics and obtained a GPA of at least 3.0 on a 4.0 scale from accredited programs. An individual plan of graduate study compatible with the student's interest and background is established by the student in consultation with an advisor. In some cases, it may be necessary to require background courses to fulfill prerequisites. In addition to Graduate School admission requirements, the Department posts specific degree requirements.

Application Deadlines

Fall:
International Applications must be received by February 1 (**January 7 preferred**) .
US Applications must be received by May 1 (**January 7 preferred**) .
Spring:

Faculty:

Co-Director
Modarres, Mohammad

Professor
Ayyub, Bilal
Christou, Aristos
Dasgupta, Abhijit
Modarres, Mohammad
Pecht, Michael
Sandborn, Peter

Associate Professor
Cukier, Michel
Pertmer, Gary A.

Assistant Professor
Vaughn-Cooke, Monifa

Affiliate Professor
Goldsman, Neil

Professor Emeritus
Mosleh, Ali
Roush, Marvin L.

Associate Professor Emeritus
Mosleh, Ali

International Applications must be received by June 1 .
US Applications must be received by October 1 (**August 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of recommendation
3. Statement of purpose(If you are planning to be a distance student, please indicate so in your statement)
4. TOEFL (all international students)
5. Resume or CV

Degree Requirements

Master of Science (M.S.)
The M.S. degree program offers thesis and non-thesis options. The thesis option requires 24 credit hours of coursework and 6 credits of thesis research. Students who enroll directly in the Ph.D. program or students who transfer into the Ph.D. program from the M.S. program by passing the Ph.D. qualifying examination may obtain a non-thesis M.S. degree upon advancing to doctoral candidacy. The non-thesis option requires 30 credit hours of coursework, a scholarly paper, and presentation. All students must complete the Program Core requirements as well as all of the Graduate School requirements.

The Professional Master of Engineering (M.Eng.) program in Reliability does not require a thesis, but students must complete at least 30 credits of approved coursework.

Doctor of Philosophy (Ph.D.)
For the Ph.D. degree, students must complete a minimum of 36 credits of approved graduate courses (a minimum of 18 credits of coursework at the University of Maryland) and 12 credits of dissertation research, with a minimum 3.0 GPA overall. In addition, students must pass the Ph.D. qualifying examination and successfully produce and defend a Ph.D. dissertation on an original research topic after the core courses and at least two additional ENRE elective courses are taken. The GPA for these four courses must be 3.5 or higher.

Facilities and Special Resources

Students and faculty have access to a host of special facilities in the College of Engineering, including the nuclear reactor, an 8-MeV electron linear accelerator; environmental chambers; mechanical testing, SEM, X-ray and imaging facilities; and extensive computer resources. The program also has a complete failure analysis laboratory.

Financial Assistance

Financial assistance is available to highly qualified students in the form of research and teaching assistantships. The most outstanding applicants are offered fellowships. Students seeking financial assistance are asked to submit with their applications a current resume or CV as well as a statement regarding their qualifications and/or past research or teaching experience. Financial assistance is sought for all worthy students.

Contact Information

Detailed information regarding our graduate programs may be found on our website.

Director of Reliability Engineering Graduate Program/Prof. Mohammad Modarres
Department of Mechanical Engineering
0151 Glenn L. Martin Hall

College Park, MD 20742
Telephone: (301) 405-5226
Fax: (301) 405-9601
modarres@umd.edu

http://enre.umd.edu/

Coordinator of Graduate Studies/Tameka Boggs
Department of Mechanical Engineering
2180 Glenn L. Martin Hall
College Park, MD 20742
Telephone: (301) 405-4216
Fax: (30) 314-8015
tboggs@umd.edu

http://www.enme.umd.edu/grad

Associate Director of Graduate Studies/Kerri Poppler James
Department of Mechanical Engineering
2178 Glenn L. Martin Hall
College Park, MD 20742
Telephone: (301) 405-8601
Fax: (301) 314-8015
kjames3@umd.edu

http://enme.umd.edu/grad

Director of Graduate Studies/Prof. Hugh A. Bruck
Department of Mechanical Engineering
2174 Glenn L. Martin Hall
College Park, MD 20742
Telephone: (301) 405-8711
Fax: (301) 314-8711
bruck@umd.edu

http://www.enme.umd.edu/grad

Courses: ENRE

Related Programs and Campus Units

Engineering: Professional Master of Engineering
Graduate Certificate: Engineering

Engineering: Systems Engineering (ENSE)

Abstract

Students in the broadly-based, cross-disciplinary Master of Science in Systems Engineering (ENSE) program at ISR benefit both academically and professionally by:

- Being exposed to a wide range of systems engineering principles and software tools tailored toward support for visual modeling of systems, requirements engineering, system-level modeling, optimization and trade-off analysis, and human factors engineering.

- Becoming familiar with the financial and management issues associated with complex engineering systems.

Faculty:

Director
Austin, Mark A.

Professor
Abed, Eyad
Adomaitis, Raymond A.
Ball, Michael O.
Baras, John S.
Barg, Alexander
Cleaveland, W. Rance
Cohen, Avis H.
Ephremides, Anthony
Espy-Wilson, Carol Y.
Fu, Michael C.
Ghodssi, Reza
Gupta, Satyandra K.
Krishnaprasad, P.S.

- Acquiring a deep understanding of one particular application area.

- Becoming familiar for opportunities for leadership within the systems engineering profession.

Designed with substantial industry input, the ENSE curriculum represents the University of Maryland's first multi-college graduate degree program involving the A. James Clark School of Engineering.

In addition to the technical management of systems projects, the ENSE program covers a wide range of topics, from systems definition, requirements and specifications, to systems design, implementation, and operation. Students specialize in one technical area, selected from computer and software systems, communication and networking systems, signal processing systems, control systems, manufacturing systems, operations research, transportation systems, and robotics. The ENSE program draws upon the extensive engineering, computer science and management experience of the of University of Maryland faculty. The program makes optimum use of the university's advanced facilities, including extensive libraries of numerical, symbolic, and visualization software, engineering workstations, and wireless communication networks.

Admissions Information

Admission to the ENSE program is competitive. The program looks for strong evidence of motivation and achievement and/or significant professional experience in engineering and/or the sciences. At a minimum, all applicants must meet the general admission requirements of the Graduate School, graduation from a regionally accredited college or university with a B average (or 3.0 on a 4.0 scale). Also key are three (3) strongly positive letters of recommendation, usually from current or recent instructors, employers, or supervisors; competitive scores on standardized tests (the GRE general test with writing assessment is required); and an articulate statement of appropriate goals and interests. Applicants should have a solid background in engineering, math or science. Prospective and current students may seek support for their studies through graduate research assistantships or graduate fellowships. Students currently working in industry, the military, or the government, who plan to pursue their graduate studies part-time, might ask their employers about tuition assistance. All applicants are encouraged to explore sources of external funding; a number of comprehensive Internet sites, such as fastweb.com, offer detailed information and application instructions.

Application Deadlines

Fall:
International applicants must submit application and all supporting materials by February 1 .
U.S. citizens must submit application and all supporting materials by March 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

- GRE. Official GRE scores should be sent directly to the University of Maryland (institution code 5814) through ETS.
- TOEFL. Official TOEFL scores should be sent directly to the University of Maryland (institution code 5814) through ETS.
- Official transcripts (original hard copy required)
- Residency information form (U.S. citizens and permanent residents only)
- Certification of Finances form (international applicants only)

Makowski, Armand M.
Marcus, Steven I.
Moss, Cynthia F.
Narayan, Prakash
Nau, Dana S.
Raghavan, Subramanian
Rubloff, Gary W.
Shamma, Shihab
Tits, Andre L.

Associate Professor
Abshire, Pamela
Austin, Mark A.
Barua, Rajeev K.
Cukier, Michel
Herrmann, Jeffrey W.
Horiuchi, Timothy
La, Richard
Lovell, David J.
Martins, Nuno M. L. C.
Qu, Gang
Shapiro, Benjamin
Srivastava, Ankur
Ulukus, Sennur
Zhang, Guangming

Assistant Professor
Bergbreiter, Sarah E.
Chopra, Nikhil

- International applicants who are already in the U.S. must provide copies of the I-20, I-94, and passport visa stamp
- 3 Letters of recommendation
- Statement of Goals
- All other supporting documents should be sent to: University of Maryland College Park, Enrollment Services Operations, Application for Graduate Admission, Rm 0130 Mitchell Building, College Park, MD 20742

Degree Requirements

Master of Science (M.S.)
General requirements for the master's thesis and non-thesis options are those of the University of Maryland Graduate School. All requirements must be completed within 5 years. The thesis option requires each student to obtain a total of 30 credit hours: 24 hours of coursework and six (6) hours for the thesis project to complete the program. The coursework includes 18 credits for the six core courses (four courses from the systems engineering core and two courses from the management core), and two (2) elective courses. The elective courses must be taken from one specialization area. The master's thesis project demonstrates the practical implications of systems engineering principles. The thesis project may be related to a practical industrial system, and must be supervised by the academic advisor.

The non-thesis option requires each student to obtain a total of 30 credit hours of coursework to complete the program (four courses from the systems engineering core, two courses from the management core, and four elective courses). The elective courses must be taken from not more than two specialization areas. In addition, students must complete a scholarly paper. Expectations of the scholarly paper: While less detailed and complex than the thesis, the scholarly paper also contributes to systems engineering research. For example, a student might chose to write a literature review, identify and propose a solution to a systems problem encountered on the job, or prepare a systems case study. The scholarly paper is prepared under the supervision of the student's academic advisor. It also must be read by at least one additional ISR faculty member, and approved by the ENSE graduate director. No specific format is required by the Graduate School.

Facilities and Special Resources

Modern laboratory, computation, and networking environments play an indispensable role in both the development and day-to-day operation of the research and education programs at the Institute for Systems Research. In all of the ISR laboratories, real-life experiments and associated research studies are enabled through the integrated design of automation and information engineering systems. Computational environments support advanced numerical simulation, sensing and control, and automated design of complex heterogeneous engineering systems. Networking environments play an indispensible role in enabling of interdisciplinary teams of faculty and students to work together. Prototype designs in both hardware and software have led to technological discoveries and patentable inventions.

ISR was established in 1985 as one of the first six National Science Foundation Engineering Research Centers (ERCs). Now a self-sustaining ERC, it is a permanent state-supported institute of the University of Maryland, within the A. James Clark School of Engineering. ISR faculty and graduate students perform basic and applied research with an emphasis on six major research directions: systems engineering methodologies and tools, global communications systems, sensor-actuated networks, next generation product-realization systems, societal infrastructure systems, and cross-disciplinary systems engineering education. ISR seeks a cohesive and balanced approach to the modeling, design, and control of large heterogeneous systems, bringing together a

diversified team of outstanding engineers, scientists, and students to research, develop, and implement advances in systems engineering.

Financial Assistance

Prospective and current students may seek support for their studies through graduate research assistantships with ISR faculty or graduate fellowships. Students currently working in industry, the military, or the government, who plan to pursue their graduate studies part-time, might ask their employers about tuition assistance. All applicants are encouraged to explore sources of external funding; a number of comprehensive Internet sites, such as fastweb.com, offer detailed information and application instructions.

Contact Information

Information regarding the program may be obtained by writing to:

Master of Science in Systems Engineering (ENSE) Program
Institute for Systems Research
2175 A.V. Williams Building (115)
University of Maryland College Park
MD 20742
Telephone: (301) 405-4419
Fax: (301) 314-9920
ensegrad@deans.umd.edu

http://www.isr.umd.edu/MSSE/index.htm

Courses: ENSE

Related Programs and Campus Units

Engineering: Chemical Engineering
Engineering: Electrical & Computer Engineering
Computer Science
Engineering: Civil and Environmental Engineering
Business and Management
Engineering: Materials Science and Engineering
Engineering: Aerospace Engineering
Mathematics
Engineering: Mechanical Engineering
Engineering: Professional Master of Engineering
Graduate Certificate: Engineering

Engineering: Telecommunications (ENTS)

Abstract

The Master's in Telecommunications Program offers students a unique opportunity to engage in cross-disciplinary coursework from both the Electrical and Computer Engineering Department of the A. James Clark School of Engineering and the Robert H. Smith School of Business at the University of Maryland. This extraordinary combination culminates in a degree that prepares students for the broad range of rigors and issues that encompass the dynamic telecommunications industry.

The program covers several different areas including Information System Security, Wireless Communications, Networking, and Business and Management for the telecommunications industry. The program may be pursued either full-time or part-time.

Faculty:

Director
Safar, Zoltan

Associate Director
Dellomo, Michael
Mercado, Alejandra

Lecturer
Boroumand, Jahangir

Advisor
Dellomo, Michael

All courses are scheduled in the evening to suit working professionals, while some courses additionally offer daytime sections.

Liaison
Boroumand, Jahangir

The program is designed around a core curriculum that provides a solid technical foundation and management background. The Master's in Telecommunications degree requires successful completion of 30 credits and a scholarly paper. Please visit our Degree Requirements page for detailed information.

Students may choose from a wide range of electives to develop their interests and complement their career goals. Please visit our Course Descriptions page for a detailed listing of our courses. In addition to the courses listed there, special topics electives are regularly offered. As our program keeps up with industrial trends, these courses focus on emerging, cutting-edge topics.

Please see our website, www.telecom.umd.edu, for the most current information.

Admissions Information

For the most current and detailed information regarding admissions and deadlines for the Master's in Telecommunications, please refer to our Admissions page.

The program is open to applicants holding a regionally accredited baccalaureate degree in engineering, computer science, math, physics or related technical fields with a minimum GPA of 3.0. Applicants with an undergraduate GPA of slightly less than 3.0 may be considered if they have demonstrated strong performance in prior graduate study and/or professional experience.

Because of the program's rigorous technical core, applicants must have sufficient mathematical backgrounds (e.g. successful completion of Calculus I, Calculus II, and Differential Equations). The GRE will be strongly considered; however, it is not required for admission.

This program is professional in nature and has a non-standard tuition. Tuition for the 2015-2016 academic year is $1037.00 per credit. The tuition rate is the same for all students, regardless of residency or citizenship.

Application Deadlines

Fall:
Domestic students: May 1 .
International Students: FEBRUARY 1 .
Spring:
Domestic Students: October 1 .
International Students: JUNE 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

- Official College Transcripts
- 3 Letters of Recommendation
- Statement of Purpose
- Resume
- International applicants: Official TOEFL or IELTS scores

Degree Requirements

Master of Science (M.S.)

Requirements to earn the Master's in Telecommunications degree include completing 30 credit hours of course work, achieving a cumulative grade point average (GPA) of at least 3.0, and submitting a satisfactory scholarly paper. The 30 credits include eight required courses and two elective courses. All graduate students at the University of Maryland are required to maintain a 3.0 GPA each semester to remain in good standing.

Additional courses beyond the required courses must be approved by the Program Office and should not impede the student's progress towards degree completion. ALL courses taken at the University of Maryland count towards the student's cumulative GPA.

Please visit our Degree Requirements page for detailed information.

Facilities and Special Resources

Students enrolled in the Program are allowed exclusive access to the Telecommunications PC Lab.

Financial Assistance

Since the Master's in Telecommunications Program does not normally offer financial support in the form of graduate assistantships, many of our students find assistantships in other units, especially non-academic units, which do not have graduate students.

Contact Information

Master's in Telecommunications Program Office
2433 A.V. Williams Building, University of Maryland,
College Park
MD 20742
Telephone: 301-405-3682
Fax: 301-314-9324
telecomprogram@umd.edu

http://www.telecom.umd.edu

Courses: ENTS

Related Programs and Campus Units

Engineering: Electrical & Computer Engineering

English Language and Literature (ENGL)

Faculty:

Chair
Cartwright, Kent

Associate Chair
Coletti, Theresa M.

Director
Bauer, Ralph
Jelen, Sheila
Moser, Thomas Colborn, Jr.
Plumly, Stanley

Abstract

The Department of English offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees; particular strengths of the department include early British literature, especially that of the Renaissance; American literature; literature of the African diaspora;postcolonial and transnational literary studies; digital humanities; feminist theory and gender studies; and composition and rhetoric. The Department also offers a Master of Fine Arts degree in Creative Writing (See listing for Creative Writing). Most students enrolled in graduate programs in English Language and Literature seek employment in higher education, but many also seek non-academic employment in publishing, business and technical writing, administration, and personnel management. To assist with

placement, the department has a Placement Director and the university has a Career Development Center.

Admissions Information

In addition to fulfilling Graduate School requirements, applicants to the M.A. degree program should present a 3.5 GPA in English and 24 hours of upper-level English courses. Applicants to the Ph.D. degree program should present at least a 3.7 GPA and a B.A. degree, normally in English Language and Literature. All M.A. and Ph.D applicants should submit a single critical writing sample of 12-20 pages as indicated on the application guidelines. General GREs are also required. For best consideration, complete applications for all degree programs should be submitted by December 8. Applications are not accepted after December 8. The Admissions Committee will begin reviewing applications immediately. Admission is for the Fall semester only.

Application Deadlines

Fall:
December 8 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General required
2. 3 Letters of Recommendation from current or former teachers
3. Unofficial list of relevant coursework
4. Official transcripts from all schools attended
5. A single critical writing sample (12-20 pages)

Degree Requirements

Doctor of Philosophy (Ph.D.)

The Ph.D. degree program requires a total of 36 credit hours of graduate work. PhD students must also 1) pass a qualifying examination in their areas of specialization; 2) demonstrate, through examination or coursework, evidence of reading competence in a foreign language related to their areas of specialization; and 3) complete a dissertation. Applicants to the Ph.D. program normally must have a B.A in English Language and Literature. Applicants who wish to pursue a Ph.D. but who do not have a B.A.in English Language and Literature may apply to the M.A. program. In exceptional cases the Admissions Committee may decide to admit a student with a B.A. degree other than in English Language and Literature with the requirement that the student complete extra course work as deemed necessary.

Master of Arts (M.A.)

The M.A. degree program requires 30 credit hours of graduate work distributed to assure coverage of major historical fields. The student either may take 24 hours of coursework and write a thesis for the other six hours, or may take 30 hours of coursework and do a capstone writing project. The department also offers a special M.A. with a Concentration in Composition and Rhetoric; this degree program requires 30 credit hours of graduate work, provides thesis and non-thesis options, and balances courses in literature with courses in the theory of composition and rhetoric.

Facilities and Special Resources

Resources for research in the College Park and Washington, D.C. area are unsurpassed. The university's libraries hold over 2,000,000 volumes. In addition to the outstanding holdings of the Library of Congress, the area also offers the specialized resources of the

Associate Director
Casey, Maud

Distinguished University Professor
Plumly, Stanley

Professor
Auchard, John
Auerbach, Jonathan D.
Caramello, Charles A.
Carretta, Vincent
Cartwright, Kent
Casey, Maud
Cohen, William A.
Coletti, Theresa M.
Collier, Michael R.
Collins, Merle
Donawerth, Jane L.
Fraistat, Neil R.
Hamilton, Donna B.
Kauffman, Linda
Leinwand, Theodore B.
Levine, Robert S.
Logan, Shirley W.
Norman, Howard
Pearson, Barry L.
Ray, Sangeeta
Richardson, Brian
Rosenthal, Laura
Smith, Martha Nell
Wang, Orrin
Washington, Mary Helen
Wyatt, David M.

Associate Professor
Arnold, Elizabeth
Bailey, Amanda
Bauer, Ralph
Chico, Tita
Coleman, Linda K.
Coles, Kimberly
Enoch, Jessica
Gaycken, Oliver
Israel, Michael
Jelen, Sheila
Kirschenbaum, Matthew G.
Lindemann, Marilee
Mallios, Peter
Moser, Thomas Colborn, Jr.
Nunes, Zita
Ontiveros, Randy
Passannante, Gerard
Robertson, Kellie
Rudy, Jason
Rutherford, Charles S.
Walter, Christina
Weiner, Joshua
Wible, Scott
Wong, Edlie

Assistant Professor
Adsanatham, Chanon
Balachandran Orihuela, Sharada
Fleming, Julius
Kill, Melanie
Konstantinou, Lee
Kraus, Kari Michaele
Mitchell, Emily
Trudell, Scott
Valiavitcharska, Vessela V.

Affiliate Associate Professor
Coles, Kimberly

Folger Shakespeare Library, Dumbarton Oaks, the National Archives, the Smithsonian Institution, and the National Center for the Study of the Visual Arts.

UMCP is a member of the Consortium of Institutions in the Washington area, which permits graduate students at College Park to enroll in courses at other universities for graduate credit at UMCP. Graduate students in English also may take courses for graduate credit at the Folger Institute of Renaissance and Eighteenth-Century Studies, which runs a series of seminars by distinguished scholars each year.

Financial Assistance

The English Department, in conjunction with the College of Arts and Humanities and the Graduate School, awards a small number of fellowships to exceptional PhD candidates. The English Department also awards teaching assistantships, the primary form of financial aid. Currently, about 8-10 teaching assistantships are available each year to incoming PhD students and 5 half-time teaching assistantships are available each year to incoming MA students.

Contact Information

Additional information on admission, degree requirements, and financial aid can be obtained from:

Manju Suri, Academic Coordinator
2116 Tawes Hall University of Maryland
College Park
MD 20742
Telephone: (301) 405-3798
engl-grad@deans.umd.edu

http://www.english.umd.edu

Courses: ENGL ENGL

Related Programs and Campus Units

Communication

Coles, Kimberly
Enoch, Jessica

Professor Emerita
Berlin, Adele
Fahnestock, Jeanne D.
Flieger, Verlyn B.
Fry, Gladys M.
Leonardi, Susan
Loizeaux, Elizabeth Bergmann
Miller, Mary R.
Peterson, Carla L.

Professor Emeritus
Barry, Jackson G.
Bryer, Jackson R.
Coogan, Robert M.
Cross, Richard K.
Freedman, Morris
Isaacs, Neil D.
Lawson, Lewis A.
Mack, Maynard, Jr.
Peterson, William S.
Salamanca, Jack R.
Winton, Calhoun

Associate Professor Emerita
Beauchamp, Virginia W.

Associate Professor Emeritus
Hamilton, Gary D.
Hammond, Eugene R.
Herman, Harold J.
Marcuse, Michael J.

Entomology (ENTM)

Abstract

The Department of Entomology offers both the Doctor of Philosophy and Master of Science degrees. Graduate students may specialize in a range of focus areas in both basic and applied insect science. Focus areas include insect ecology and behavior; physiology and morphology; evolution and biosystematics; insect pathology; molecular biology and genetics; pesticide technology, toxicology and environmental risk assessment; freshwater and estuarine entomology; and pest management and biological control.

Employment opportunities for graduates exist in industry; academia and extension; federal, state and local governments; private and non-profit arenas; and in international and national spheres.

Admissions Information

Faculty:

Chair
Pick, Leslie

Graduate Director
Shultz, Jeffrey

Distinguished Scholar-Teacher
St.Leger, Raymond

Professor
Brown, Amy
Ma, Michael
Mitter, Charles
O'Brochta, David A.
Palmer, Margaret
Pick, Leslie
Raupp, Michael
St.Leger, Raymond
Via, Sara

Students applying for graduate work in entomology are expected to have strong backgrounds in the biological or agricultural sciences, chemistry, genetics, and mathematics. An undergraduate degree in entomology is not required, but a strong basic preparation is preferred for admission to the program.

Admission is granted on the basis of the following criteria by the Graduate Affairs Committee: Analysis of transcripts, including course selection and GPA, letters of recommendation, statement of purpose for pursuing the degree, GRE scores, and acceptance by a graduate faculty advisor. International applicants must also submit proof of English proficiency (TOEFL, iBT or IELTS scores). Acceptance by an advisor is absolutely required; thus, it helps to make contact with faculty when applying.

Upon admission to the M.S. or Ph.D. program, the student's study committee suggests a program of course work and approves a detailed research proposal.

Application Deadlines

Fall:
Applications must be received by January 1 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. University of Maryland application for graduate studies
2. Academic transcript(s)
3. Scores of the Graduate Record Exam General Aptitude Test (institutional code is 5814; departmental code not required)
4. Scores of the Graduate Record Exam Advanced Biology Test (optional but include if available)
5. 3 letters of recommendation from people familiar with the applicant's abilities and aptitude for graduate work
6. Statement of purpose/research interests and professional objectives (can be reasonably broad; 1-2 pages in length)
7. International students must submit scores from the TOEFL, iBT or IELTS. Maryland's institutional code is 5814; no departmental code is needed. Students who take the iBT or IELTS exams do not need to take the TSE.
8. Applicants are encouraged to contact Entomology faculty with shared research interests. To explore matches of your interests with those of ENTM faculty, see the Entomology website.

Degree Requirements

Master of Science (M.S.)
In the M.S. program, the student is given latitude in the selection of the advisory study committee, the choice of a study area, and the selection of a research program. The student must take core courses and specific courses required by the study area. The M.S. degree is awarded following the successful completion of course work (24 credits), thesis research (6 credits) and thesis defense.

Doctor of Philosophy (Ph.D.)
The Ph.D. program provides diverse opportunities for the selection of a dissertation question, composition of advisory committee, and selection of an area of specialization. In addition to core course requirements, course work (28 credits) and dissertation research (12 credits), targeting an area of specialization is determined by the advisory study committee. Following completion of most course work, the Ph.D. student is given an oral qualifying examination for advancement to candidacy, and the degree is awarded after successful completion of the dissertation defense exam.

Facilities and Special Resources

Associate Professor
Gruner, Daniel
Hawthorne, David
Hooks, Cerruti
Lamp, William
Neel, Maile
Shrewsbury, Paula
Shultz, Jeffrey
Wang, Jian

Assistant Professor
Hamby, Kelly
vanEngelsdorp, Dennis

Adjunct Professor
Davis, Donald
Labandeira, Conrad
Pettis, Jeffery S.
Schultz, Ted

Adjunct Associate Professor
Lill, John
Scheffer, Sonja

Affiliate Associate Professor
Pal, Utpal
Wu, Louisa

Lecturer
Kent, B.
O'Brien, Tammatha
Shapiro, Leo
Shofner, Marcia

Professor Emerita
Thorne, Barbara

Professor Emeritus
Barbosa, Pedro
Davidson, John
Dively, Galen II
Hellman, John
Messersmith, Donald

The department is housed in a modern research facility on campus, where state-of-the-art offices, laboratories, environmental growth chambers, multimedia classrooms, and lecture halls provide an excellent environment for research and teaching. Students have individual work stations and access to sophisticated computer graphic facilities. The department also shares extensive technical expertise and scientific equipment with other departments on campus. The university's strategic location in the Washington, DC area provides many opportunities for students to conduct research and gain hands-on experience in federal facilities, such as the Smithsonian Institution, USDA-ARS Beltsville Agricultural Research Center, Walter Reed Army Institute of Research, and NIH. Vast resources are available in the university's library system and nearby federal libraries. The USDA's National Agriculture Library at Beltsville is only four miles from the campus, and the Library of Congress is in nearby Washington, DC. Besides the main campus, the Maryland Agriculture Experiment Station has Research and Education Centers in the state where field and laboratory work is carried out on urban and agricultural insects. Land use and technical services at these centers are available to faculty and students.

Financial Assistance

Graduate students are supported primarily in two ways. Many students are supported by extramural funding sources, usually obtained by the student's faculty advisor or student for research on a specific topic. The second type of support is provided by the department from internal funds via university and departmental fellowships, and teaching and research assistantships. Teaching and research assistantships are available on a competitive basis. Teaching assistants usually instruct undergraduate laboratory and recitation classes and receive in return a tuition waiver of ten credits each semester. Those students whose records indicate superior academic achievement and promise may also be competitive for university and departmental fellowships. Several part-time employment opportunities are also available in governmental and private research and developmental laboratories in the area. Regardless of the initial source of funding, the department makes a financial commitment to each graduate student. In the case of master's students, support is provided for the first three years of the program only. In the case of doctoral students, five years of support is provided but must be used during the first six years of the student's program. Support is usually for the full 12 months.

Contact Information

The departmental website describes the mission and administrative organization of the department; the faculty and staff; the teaching, research, and extension programs; and the facilities. The website also gives additional information on the graduate program, including requirements for admission, course requirements, examinations, seminars, research areas and facilities.

Graduate Director, Dr. Jeffrey Shultz
Department of Entomology, 4112 Plant Sciences Building, University of Maryland, College Park,
MD 20742-4454
Telephone: (301) 405-7519
Fax: 301-314-9290
jshultz@umd.edu

http://www.entm.umd.edu/

Courses: ENTM BSCI

Related Programs and Campus Units

Biological Sciences
Marine-Estuarine-Environmental Sciences
Sustainable Development and Conservation Biology

Environmental Science and Technology (ENST)

Abstract

The Department of Environmental Science and Technology (ENST) offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. ENST students can choose to work within one of four specializations: Soil and Watershed Sciences; Ecological Technology Design; Wetland Science; Ecosystem Health and Natural Resource Management.

Admissions Information

Students seeking admission should have strong training in the basic sciences and mathematics. To be admitted with full admission status, a student must have completed a minimum of one semester of Calculus and a total of at least 20 credits in some combination of Chemistry, Physics, Biology or Mathematics (beyond Calculus I). It is also helpful for applicants to have completed other courses in science and engineering. Applicants to the M.S. program must have earned a B.S. degree in a related field with an undergraduate cumulative GPA of 3.0 or higher. Applicants to the Ph.D. degree program must have earned an M.S. Degree in a closely related field. In special cases students may be admitted to a Ph.D. program without first completing an M.S. degree provided these students have: 1) an exceptional academic record and test scores; and 2) have demonstrated significant research experience during their B.S. program (such as completion of a research based honors thesis.) Graduate Record Examination scores (GRE - General Test) are required of all applicants. International applicants must also submit TOEFL scores.

Application Deadlines

Fall:
Applications must be received by January 15 (**January 1 preferred**) .
Spring:
International applications must be received by June 1 .
Domestic applications must be received by August 15 .

Application Requirements

1. GRE General Test
2. 3 Letters of Recommendation

Degree Requirements

Doctor of Philosophy (Ph.D.)

Graduate School Requirements: To earn an Ph.D. degree, the University of Maryland Graduate School requires that the student complete a minimum of 12 credits of dissertation research (899) and complete and successfully defend a dissertation based on original research.
ENST Departmental Core Requirements: All ENST Ph.D. students are expected to complete a minimum of 50 credits beyond the B.S. degree (in addition to research credits 898 and 899) and are required to complete ENST 602, 702 and two graduate level statistics courses (these can be taken during either the M.S. or Ph.D. program), and two semesters of Graduate Seminar (ENST 798).
Specialization Requirements: ENST Ph.D. students are expected to have completed all of the M.S. requirements for the particular specialization chosen. In addition to having met the M.S. requirements, the Soil and Watershed Sciences specialization requires that Ph.D. students complete one semester of graduate level physical chemistry or biochemistry and one additional graduate level course in chemistry, biochemistry, physics, mathematics, engineering, or computer science; the Ecological Technology Design specialization requires that Ph.D. students complete one semester of graduate level systems modeling, and one additional graduate level course in ecology, ecological design or ecological engineering; the Wetland Science specialization requires that Ph.D. students complete one graduate level course in modeling, and two additional graduate level courses from within the areas of Ecology, Soil Science, or Hydrology; the Ecosystem Health and Natural Resource Management specialization requires

Faculty:

President Emeritus
Miller, Raymond J.

Chair
Bowerman, William W.

Professor
Baldwin, Andrew H.
Coale, Frank J.
Harrell, Reginal M.
Hill, Robert Lee
James, Bruce R.
Kearney, Michael
Rabenhorst, Martin C.
Shirmohammadi, Adel
Weil, Raymond R.

Associate Professor
Felton, Gary Kent
Joshua McGrath
Kangas, Patrick C.
Leisnham, Paul
Momen, Bahram
Needelman, Brian A.
Tilley, David R.

Assistant Professor
Lansing, Stephanie
Negahban-Azar, Masoud
Pavao-Zuckerman, Mitchell
Peer, Wendy A.
Yarwood, Stephanie A.
Yonkos, Lance

Senior Research Scientist
Fisher, Daniel

Principal Agent
Tjaden, Robert L.

Extension Associate
Steinhilber, Patricia M.

Adjunct Professor
Landa, Edward
Tamboli, Prabhakar

University Affiliate
Armbruster, Peter
Binford, Gregory D.
Bryant, Ray B.
Iwanowicz, Luke R.
Kleinman, Peter J.A.
Lang, Megan W.
McCarty, Greg W.
Mulbry, Walter
Pachepsky, Yakov
Pavao-Zuckerman, Mitchell
Penn, Chad J.
Pinkney, Alfred E.
Teasdale, John R.
Whigham, Dennis
Ziska, Lew H.

Professor Emeritus
Fanning, Delvin S.

Ph.D. students to complete three additional graduate level courses in Ecosystem Health and Natural Resource Management.	Ross, David S. Weismiller, Richard A.

Master of Science (M.S.)

Graduate School Requirements: To earn an M.S. degree, the University of Maryland Graduate School requires that a student to complete a minimum of 24 semester hours of graduate level classes (400 lever or above) beyond the B.S. degree, plus an additional six hours of thesis research credit (799). Of the 24 hours required in graduate courses, at least 12 must be earned in a major area and a minimum of 12 credit hours must be 600 level or above. Defense of a thesis based on the student's research is required for the degree.
ENST Departmental Core Requirements: All ENST M.S. students are required to complete ENST 602 and 702, two semesters of Graduate Seminar (ENST 798), and one graduate level statistics course.
Specialization Requirements: The Soil and Watershed Sciences specialization requires that M.S. students complete a total of twelve credits of graduate level soil science courses among any four of the following five areas: soil chemistry, soil physics, pedology, soil biology, soil fertility. The Ecological Technology Design specialization requires that M.S. students complete a total of twelve credits of graduate level courses that have been approved by the student's advisory committee. Six credits must be in ecology and six credits must be in ecological design or related engineering courses. The Wetland Science specialization requires that M.S. students complete a total of twelve credits from a list of approved graduate level courses . A minimum of three credits must be earned from each of these groups: Ecology, Soil Science, Hydrology; the Ecosystem Health and Natural Resource Management specialization requires that students complete a total of twelve credits from graduate level courses approved by their advisory committee - ENST604 (3 credits) and 9 additional credits in Ecosystem Health and Natural Resource Management.

Facilities and Special Resources

The Department has many well-equipped laboratories designed to carry out basic and applied research in Soil and Watershed Sciences, Ecological Technology Design, Wetland Science, and Ecosystem Health and Natural Resources Management. Laboratories are located on the College Park campus in H.J. Patterson Hall and the ANSC/AGEN Building. New state-of-the-art greenhouse facilities on campus and a statewide network of research and education centers as well as our proximity to Chesapeake Bay provide access to a wide range of environmental conditions for research. Students have access to computer resources in the department and a comprehensive computer center located on campus. The University Libraries on campus and the National Agricultural Library located nearby, supplemented by the Library of Congress, make the library resources accessible to students among the best in the nation. Many ENST projects are conducted in cooperation with other departments on campus and with professionals at various scientific centers in the area. Scientists at the USDA-ARS, US Geological Survey, the National Academy of Sciences, NASA, National Institutes of Health, Department of Energy, Smithsonian, and National Park Service, as well as other agencies, have cooperated with ENST faculty on various projects. Scientists from some of these agencies have adjunct appointments in the Department, have taught special courses at the University, and participate on graduate committees.

Financial Assistance

ENST offers a number of graduate assistantships to qualified applicants that are awarded on a competitive basis. To apply, use the form for requesting financial assistance included in the Graduate School application packet. In addition to a competitive stipend, graduate assistants receive tuition remission and are offered excellent health benefits by the University of Maryland.

Contact Information

ENST Admin. Asst. Tina Scites
Dept. Environmental Science and Technology, 1426 An.Sci./Ag.Eng. Bldg.,
University of Maryland, College Park
MD 20742
Telephone: 301-405-1198
Fax: 301-314-9023
tscites@umd.edu

http://www.enst.umd.edu/graduate

ENST Director of Graduate Studies/Dr. Martin C. Rabenhorst
Dept. Environmental Science and Technology, 1213 H.J. Patterson Hall,
University of Maryland, College Park,
MD 20742
Telephone: 301-405-1343
Fax: 301-314-2763
gradstudies-enst@umd.edu

http://www.enst.umd.edu/graduate

Courses: ENST

Family Science (FMSC)

Abstract

The Department of Family Science prepares students to describe, explain, and improve the quality of family life through applied research, education, therapy, human services, policy analysis, and advocacy. The approach is interdisciplinary, emphasizing individual, interpersonal, and social change. The program of study is based on a systems or ecological paradigm, combining the perspectives of interrelated professional fields including family science, couple and family therapy, maternal and child health, family policy, behavioral science, and human services. Graduates are prepared for careers in the public, non-profit and private sectors, including university teaching, research, family policy analysis, and administrative positions in human service and public health programs.

The Department offers graduate programs leading to the Master of Science (M.S.) in Couple and Family Therapy, Doctor of Philosophy (Ph.D.) in Family Science, and Doctor of Philosophy (Ph.D.) in Maternal and Child Health (MCH) degrees. Students applying to the PhD program in Family Science should have a Master's degree in Family Science or a related behavioral or social science. It is possible for a limited number of students to be accepted into the Family Science Ph.D. program with only a Bachelor's degree, but they must complete a Master of Science (M.S.) degree in Couple and Family Therapy en route to the Ph.D. MCH applicants must have a Master's Degree in Public Health (MPH) or a Master's in applied behavioral or biological science. MCH students must complete missing MPH core courses (biostatistics, epidemiology, environmental health sciences, health services administration, and health behavior) within one academic year of program entry.

The Doctor of Philosophy (Ph.D.) program in Family Science provides an interdisciplinary, research-oriented approach to the discovery and application of knowledge about families. This exciting program examines both internal family processes and the dynamic interaction of families with the biological, psychological, social, political, and economic aspects of their environment. Graduates are prepared for a number of careers in the public, non-profit, and private sectors, including university teaching, research, family policy analysis, and administrative positions in human service programs.

The Ph.D. program adopts an ecological or systems approach to the study of families and the problems they face in today’s society. The program of study provides doctoral students with a broad knowledge of family theory, family health, research methodology, family policy, family programs, ethnic families, and major issues confronting contemporary families. Students also learn to design, implement, and evaluate culturally-sensitive interventions addressing family needs and to analyze the consequences of public/private policies on family well-being.

Faculty:

Chair
Anderson, Elaine A.
Anderson, Elaine A.

Professor
Epstein, Norman B.
Goldscheider, Frances
Hofferth, Sandra L.
Koblinsky, Sally A.
Quinn, Sandra Crouse

Associate Professor
Bynum, Mia Smith
Kim, Jinhee
Leslie, Leigh A.
Mokhtari, Manouchehr
Roy, Kevin
Shenassa, Edmond D.

Assistant Professor
Jones, Marian Moser

Research Assistant Professor
Grutzmacher, Stephanie
Maring, Elisabeth F.

Professor of Practice
Kessel, Saumuel 'Woodie'

Affiliate Associate Professor
Goldscheider, Frances

Instructor
Werlinich, Carol A.

Senior Lecturer
Tripp, Kerry
Zeiger, Robyn S.

Professor Emerita
Braun, Bonnie

Professor Emeritus
Billingsley, Andrew
Gaylin, Ned L.

Admissions Information

The Department seeks students who are imaginative, intelligent, and highly motivated men and women with a desire for challenge, a commitment to excellence, and a well-developed sense of social responsibility. Most applicants have degrees in the applied behavioral or social sciences. However, the Department invites application from those in non-allied fields who have a proven record of occupational and/or volunteer experience in the family field. We are fortunate to attract gifted students who are concerned about social and ethical issues and who view their future profession in a broad context.

Students are selected on the basis of:

- performance in previous undergraduate and/or graduate coursework
- the strength of GRE scores taken within the last five years
- letters of recommendation
- quality of the empirical Master's Thesis (for those with a Master's degree)
- relevant work experience
- professional goals congruent with those of the program

Application Deadlines

Fall:
M.S. international applications must be received by January 1 .
M.S. applications must be received by January 15 .
Ph.D. applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

The Family Science Ph.D. program considers applications from students with a Master's or Bachelor's degree in family science, public health, or a related discipline. Students admitted to the Ph.D. program in Family Science with a baccalaureate degree must complete the M.S. in Couple and Family Therapy with a thesis en route to the Ph.D.

The Ph.D. program in Family Science admits students for fall semester only. **All application materials are due December 15.** Students who wish to apply for the Ph.D. program must complete the University of Maryland Graduate School Application, which includes 3 letters of recommendation, the statement of goals and research interests, and official transcripts from all institutions attended.

- Go to http://www.gradschool.umd.edu/welcome/apply_now-H.html
- Complete the online application (a $75 fee will be processed with your application)
- Mail all transcripts reflecting all undergraduate and graduate work completed or in progress to:
  University of Maryland at College Park
  Enrollment Services Operations
  Application for Graduate Admission
  0130 Mitchell Building
  College Park, MD 20742
- Standardized test scores (GREs) are to be sent directly from Educational Testing Service (if no category exists on ETS form, please fill in "other" and write FMSC, code 5814).
- GREs must be taken in time to reach our department before the December 15th deadline. - Allow 2 weeks to receive your scores.
- Letters of recommendation are to be submitted online with your graduate application or mailed directly to Graduate Admissions.
- Applicants should also have a minimum undergraduate GPA of 3.0 and a minimum graduate GPA of 3.0.

Associate Professor Emerita
Wallen, Jacqueline

Associate Professor Emeritus
Myricks, Noel
Randolph, Suzanne M.
Rubin, Roger H.

- All information provided in this application will be directly sent by Graduate Admissions to the Department of Family Science for review (you do not need to mail additional hard copies of the graduate school application to the department).

Degree Requirements

Doctor of Philosophy (Ph.D.)

The Family Science Ph.D. program requires 51 graduate credit hours beyond the master's degree, including 30 core credits (theory, family science/family health content, research methodology, statistics), 6 elective credits, 3 research internship credits, and 12 dissertation credits. All Ph.D. students must complete foundation coursework required for a master's degree in Family Science. At the discretion of the Department's Graduate Committee, students entering the Ph.D. program with a master's degree in a related discipline may make up deficiencies in coursework through classes taken at the beginning of the program. Ph.D. students must also complete two research internship projects, pass a qualifying examination, and complete a dissertation and oral defense.

Students admitted full-time to the Ph.D. program post-master's can complete this program within 3-4 years. Students with only a baccalaureate degree have the option of applying as a dual degree candidate (master's in Couple and Family Therapy, and doctorate in Family Science) requesting admission to both programs simultaneously.

Master of Science (M.S.)

The CFT curriculum has three parts: didactic coursework, clinical practica, and supervised client contact. The minimum total credits required are 48 for the non-thesis option and 51 for the thesis option. Didactic coursework is taken in conjunction with 15 credits of clinical practicum seminars and 9 credits of supervision of clinical work. In the clinical practicum, theory is applied to specific case material, with faculty supervision providing support and oversight of assigned cases.

Supervised client contact begins in the student’s first semester. Clinical students are required to gain 400 hours of face-to-face client contact, and 250 of these hours must be relational (with couples or families). The Center for Healthy Families, the couple and family therapy clinic operated by the Department, offers the opportunity to gain these hours. Clinical students receive 100 hours of supervision, both individual and group, for their client contact hours. Supervision in the Department’s clinic is provided through a range of techniques including case discussion, one-way mirror observation, video review, co-therapy, and telephone consultation during live sessions. Students may choose to do some of their clinical work in a variety of available externship sites in the local area.

Couple and Family Therapy students may pursue the thesis or non-thesis option. For thesis option students, 6 semester hours are thesis research credits taken as FMSC 799. The thesis must be approved and then defended in an oral examination. Non-thesis option students take the 3 credit FMSC 789. Non-thesis students must complete a written and oral therapy case presentation.

Facilities and Special Resources

The University's close proximity to the nation's capital, the state capital in Annapolis, federal executive departments, and headquarters of national professional and public interest associations provide research and internship placements for studying family policy unmatched by any other graduate program in the discipline. The Washington-Baltimore metropolitan area offers rich opportunities for research on culturally and socioeconomically diverse families. The campus and department have excellent computer facilities. Students have ready access to the University's extensive library systems, as well as holdings from the Library of Congress, the National Institutes of

Health, National Library of Medicine, National Archives, and many other library collections.

The Center for Healthy Families is the training and research arm of the Couple and Family Therapy Program in the Department of Family Science. Departmental graduate students and faculty provide clinical and educational services to families from surrounding communities in this state-of-the-art facility. Master's and doctoral students use data collected at the Center for research projects.

Financial Assistance

Fellowships and Graduate Assistantships are available to students admitted into the Family Science Ph.D. program. Graduate Assistantships are offered to as many CFT students as possible.

Contact Information

For additional information, please contact: Dr. Kevin Roy (Program Director of the Family Science Ph.D. program & Graduate Director).
Family Science Ph.D. Program
Department of Family Science
1142 School of Public Health, Bldg. 255
College Park, MD 20742
Phone: 301-405-3672
Fax: 301-314-9161
http://www.sph.umd.edu/fmsc

Program Director of the Family Science Ph.D. Program, Director of Graduate Studies
Kevin Roy, Ph.D.
1142 School of Public Health, Bldg. 255
College Park
MD 20742
Telephone: (301) 405-3672
Fax: (301) 314-9161
kroy@umd.edu

http://www.sph.umd.edu/fmsc/

Courses: EPIB EDMS PUAF FMSC CCJS

Related Programs and Campus Units

Public Health: Maternal and Child Health, Ph.D.
Public Health: Epidemiology Ph.D.
Psychology
Sociology

French Modern Studies (FRMS)

Abstract

The Ph.D. in French Modern Studies encompasses the Renaissance to the present. The diversity of the Graduate Faculty makes it possible for students to specialize in a wide variety of areas in French language, literature, film, and culture. The Department is part of a larger School of Languages, Literatures and Cultures that encourages and facilitates interdisciplinary scholarship, particularly in Film Studies and in Cultural Studies. Through consortia arrangements with universities in the area, including George Washington

Faculty:

Chair
Orlando, Valerie

Graduate Director
Frisch, Andrea

Professor
Brami, Joseph
Campangne, Herve Thomas

University and Georgetown University, students may augment their programs with courses otherwise unavailable at the University of Maryland.

Admissions Information

Application requirements for the Ph.D. program include: 1) Graduate School application, 2) statement of purpose (including research interests), 3) three letters of recommendation, 4) official academic transcripts for all undergraduate and graduate work, 5) GRE scores, 6) a writing sample in French, and 7) a resume or Curriculum Vitae. International applicants must also submit TOEFL scores (see Graduate School web site for more information). All applicants are automatically considered for departmental Fellowships and Teaching Assistantships.

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

- Graduate School Application
- GRE Scores
- 3 Letters of Recommendation
- Writing Sample in French
- Statement of Purpose (in English or French)
- Resume or Curriculum Vitae
- Official Transcripts
- TOEFL Scores (for International Applicants)

Degree Requirements

Doctor of Philosophy (Ph.D.)
Ph.D. students are required to take for credit a minimum of 8 courses beyond the M.A. at the 600-level or above. They are also required to pass two Qualifying Examinations consisting of a two-part Comprehensive Examination (first written, then oral, taken over two consecutive days by the end of the third semester in the PhD program) and the defense of a written Dissertation Prospectus (scheduled by the end of the fourth semester in the PhD program) before being advanced to candidacy. Ph.D. candidates then go on to write and defend a dissertation that explores significant questions about French-language literature and culture, past or present, hexagonal or extra-hexagonal.

All Ph.D. students are required to demonstrate a sound reading knowledge of one other foreign language in addition to French. A student having a recognized degree or diploma in a subsidiary area such as Music, Economics, Political Science, etc, and who plans to make substantial use of this body of knowledge for the dissertation may be permitted, with the approval of the Graduate Programs Committee, to substitute such degree or diploma for the additional foreign language requirement.

All requirements for the Ph.D. degree, except the dissertation, must be completed within five years of admission to the program. The dissertation must be completed no more than four years after advancement to candidacy. (See department website for additional information)

Mossman, Carol A.
Orlando, Valerie

Associate Professor
Benharrech, Sarah
Eades, Caroline M.
Falvo, Joseph D.
Frisch, Andrea
Scullen, Mary Ellen

Assistant Professor
Baillargeon, Mercedes

University Affiliate
Clough, Lauretta

Professor Emerita
Hage, Madeleine C.

Professor Emeritus
Verdaguer, Pierre M.

Facilities and Special Resources

With a total student enrollment of over 35,000, the University of Maryland is supported in its academic endeavors by the University Libraries, a system of eight libraries and more than three million volumes. Other area research facilities include two of the worlds outstanding libraries: the Library of Congress and the Folger Library, both of which have extensive holdings in French. The School of Languages, Literatures and Cultures, the Women's Studies Program, and the David C. Driskell Center For The Study of The Visual Arts and Culture of African Americans and The African Diaspora, among other campus units, offer seminars, lectures, and symposia on a wide variety of topics relevant to graduate students in French.

Financial Assistance

Graduate applicants can request to be considered for Teaching Assistantships and Graduate Fellowships. Graduate Teaching Assistantships carry ten-month stipends for a total of four years (provided that the student remains in good standing), plus remission of all fees (10 credits) other than those for registration and health facilities.

Contact Information

Additional information on program offerings, degree requirements and financial aid can be obtained on the department's Web site (http://www.languages.umd.edu/FrenchItalian) and by writing to:

Andrea Frisch, Associate Professor & Graduate Director
Dept. of French and Italian, University of Maryland, 3106 Jimenez Hall
MD 20742
Telephone: (301) 405-4028
Fax: (301) 314-9752
afrisch@umd.edu

http://www.languages.umd.edu/FrenchItalian

Courses: FREN

Related Programs and Campus Units

French Studies
Comparative Literature
Comparative Literature
French and Italian Languages and Literatures

French Studies (FRIT)

Abstract

The Department of French and Italian prepares students for the Master of Arts (FRIT) and Doctor of Philosophy (FRMS) degrees in French language, literature and culture. The research interests of the graduate faculty span the Renaissance to the present. For the doctoral program, consult the graduate catalog under FRMS, "Modern French Studies."

Admissions Information

The M.A. program, which offers both a thesis and non-thesis option, is open to students who have a solid grounding in French language and literature as demonstrated by a B.A.

Faculty:

Chair
Orlando, Valerie

Graduate Director
Frisch, Andrea

Professor
Brami, Joseph
Campangne, Herve Thomas
Mossman, Carol A.
Orlando, Valerie

Associate Professor
Benharrech, Sarah

or equivalent in French Studies or a closely related field. An overall Grade Point Average of at least 3.00 (on a four-point scale) at the undergraduate level is required. Further application requirements include: 1) Graduate School application, 2) statement of purpose (including research interests), 3) three letters of recommendation, 4) official academic transcripts for all undergraduate work, 5) GRE scores, 6) a writing sample in Frnech, and 7) a resume or Curriculum Vitae. International applicants must also submit TOEFL scores. All applicants are automatically considered for departmental Fellowships and Teaching Assistantships.

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

- Graduate School Application
- GRE Scores
- Three Letters of Recommendation
- Writing Sample in French
- Resume or Curriculum Vitae
- Statement of Purpose in English or French
- TOEFL Scores (for International Applicants)

Degree Requirements

Master of Arts (M.A.)
The M.A. without thesis requires a minimum of 30 credits, of which at least 18 must be selected from courses numbered 600 or above. In lieu of a thesis, students must present a Qualifying Paper of between 25 and 30 pages in length as evidence of their ability to do independent research. The M.A. with thesis requires a minimum of 24 credits, of which not less than 12 must be selected from courses numbered 600 or above. A further six credits (thesis research/French 799) are required. The M.A. thesis committee consists of 2 faculty members in addition to the student's thesis director, who serves as chairperson. There is an oral examination on the thesis, which should be a minimum of 80 pages in length. (See department websitefor complete information)

Doctor of Philosophy (see FRMS) ()

Facilities and Special Resources

With a total student enrollment of over 35,000, the University of Maryland is supported in its academic endeavors by the University Libraries, a system of eight libraries and more than three million volumes. Other area research facilities include two of the world's outstanding libraries: the Library of Congress and the Folger Library, both of which have extensive holdings in French. The School of Languages, Literatures and Cultures, the Women's Studies Program, and the David C. Driskell Center For The Study of The Visual Arts and Culture of African Americans and The African Diaspora, among other campus units, offer seminars, lectures, and symposia on a wide variety of topics relevant to graduate students in French.

Financial Assistance

Graduate applicants can request to be considered for Teaching Assistantships and Graduate Fellowships. Graduate Teaching Assistantships carry ten-month stipends for

Eades, Caroline M.
Falvo, Joseph D.
Frisch, Andrea
Scullen, Mary Ellen

Assistant Professor
Baillargeon, Mercedes

Professor Emerita
Hage, Madeleine C.

Professor Emeritus
Verdaguer, Pierre M.

two years, plus remission of all fees (10 credits) other than those for registration and health facilities.

Contact Information

Additional information on program offerings, degree requirements and financial aid can be obtained on the department's Web site at http://www.sllc.umd.edu/FrenchItalian/

Andrea Frisch Associate Professor & Graduate Director
Dept. of French and Italian University of Maryland 3106 Jimenez Hall
MD 20742
Telephone: 301-405-4028
Fax: 301-314-9752 301-314-9752
afrisch@umd.edu

http://www.sllc.umd.edu/FrenchItalian/

Courses: FREN

Related Programs and Campus Units

French Modern Studies

Geographical Sciences (GEOG)

Abstract

The Department of Geographical Sciences offers graduate study leading to the Doctor of Philosophy, Master of Professional Studies in Geospatial Information Sciences, and five year, combined Bachelors of Science and Masters of Science in Geographical Sciences degrees.

The specific research specializations represented by the faculty include:

Human Dimensions of Global Change: Coupled Human and Natural Systems. The Departments ultimate research goal is to advance an integrated understanding of the coupled Earth system including spatially distributed human processes. Our research addresses both fundamental and applied issues in coupled human and natural systems, such as population, socio-economic development, consumption and production, poverty, climate impacts and adaptation, vulnerability and mitigation, as well as the examination of policy options and trade-offs on sustainability. Our scientists investigate both the human socio-economic system and the climate system, and their linkages.

Land Cover,Land Use Change. Land cover and land-use change is a key interface between human and natural systems. Our scientists are world leaders in the remote sensing of land-cover changes. This information is actively combined with human socio-economic data to study past land cover and land use change and to inform advanced modeling of spatially-explicit future scenarios. These methods are actively being used to simultaneously address social, economic, carbon, climate, biodiversity and other aspects of land-use changes. We develop agricultural monitoring systems and look at societal impacts, adaptions and vulnerability to fire, droughts, floods, desertification, and other catastrophic events.

Geospatial Information Sciences and Remote Sensing. Collecting and interpreting geospatial data is central to everything we do as geographers, whether on computers or in the field. From local events to multi-scale processes, our faculty are developing and applying advanced remote sensing capabilities and GI Science that will help us to develop the next generation of GI technologies and understanding of the worlds

Faculty:

Chair
Justice, Christopher O.

Associate Chair
Dubayah, Ralph O.

Professor
Dubayah, Ralph O.
Goward, Samuel N.
Hansen, Matthew
Hubacek, Klaus
Hurtt, George
Justice, Christopher O.
Kasischke, Eric S.
Liang, Shunlin
Sun, Laixiang
Townshend, John R.

Associate Professor
Baiocchi, Giovanni
Geores, Martha E.
Loboda, Tatiana
Torrens, Paul

Assistant Professor
Silva, Julie
Yeo, In-Young

Associate Research Professor
Huang, Chengquan

Professor Emeritus
Prince, Stephen D.

Associate Professor Emeritus
Brodsky, Harold
Cirrincione, Joseph M.
Thompson, Derek

geography. Our strengths include advanced computer modeling, scientific and geographic visualization, sensor calibration and design, image processing, geocomputing, spatial statistics, and semantic learning.

Carbon, Vegetation Dynamics and Landscape-scale Processes. The department carries out a broad array of research focused on monitoring vegetation dynamics, with a particular focus on mapping and studying human and natural disturbances and their landscape-scale impacts, as well as changes to the earth surface as a result of climate variability. This research involves integration of field-based research with remotely-sensed observations to address key scientific uncertainties. Alterations to the global carbon cycle are changing atmospheric composition and climate with implications for human well-being and a particular focus of our research is on monitoring and modeling the terrestrial carbon cycle with unprecedented sophistication and resolution.

The Department contains several specialized groups, including the Global Land Cover Facility, as well as several smaller groupings of research interests. The Department also has close ties with cross-campus research initiatives, including the Earth Systems Science Interdisciplinary Center (ESSIC) and the Joint Global Change Research Institute (JGCRI). ESSIC is an initiative that brings together the Departments of Geography, Geology and Atmosphere and Ocean Science in a Research Institute to further encourage interdisciplinary studies to address contemporary questions in Earth Systems Science. JCGRI is a collaboration between the University of Maryland and the Pacific Northwest National Laboratory and is dedicated to understanding the problems of global climate change and their potential solutions.

Admissions Information

The Department offers courses of study leading to the Ph.D. degree and the MPS (masters in professional studies in geospatial information sciences). The MPS program is administered separately and has different admission deadlines and requirements than the Ph.D. program. See the MPS GIS Program. The Department no longer offers an M.A. option. All students are admitted directly to the Ph.D. program.

Ph.D. Program

The Department admits students to our doctoral program that have already completed a masters degree and exceptionally well qualified students who have only completed a bachelor's degree. Admitted students are required to either possess or shall develop a strong foundation in the discipline of Geography. Admission to the Ph.D. program is not limited to students with a Geography degree. Those with degrees in related disciplines such as environmental, physical or biological sciences, anthropology, economics, history and social science are encouraged to apply but may be required to undertake additional background study. Some knowledge of data processing and statistics is necessary for all applicants.

Applicants proposed program of study must clearly draw on the research strengths of existing faculty members. All applicants are strongly encouraged to contact individual faculty members (in person, by phone, or by email) to discuss their research interests and to identify potential advisors, as they will need a faculty to sponsor them for admission.

In general, the Department admits between 10-15 students each year into the Ph.D. program. Virtually all students accepted are fully-funded through assistantships and fellowships. While there is no longer a formal M.A. program, a terminal masters degree may be received for qualified students who are unable to complete the Ph.D. program.

Combined BS/MS Program

The Masters of Science degree is only earned through the Department’s combined five year BS/MS program. The combined BS/MS program enables some of the better

performing students pursuing an undergraduate Geographical Sciences major to earn both their BS and their MS in five years by counting up to 9 credits of their Geographical Sciences graduate courses towards both degrees, thus significantly reducing both the time and cost of earning both degrees.

Most students apply to the program at the end of their Junior year to begin graduate courses and be part of the program as of their Senior year. Admission into the program is strongly competitive. Students will be admitted with an undergraduate degree in Geographical Sciences, including those with an ENSP concentration in Geographical Sciences. Minimum requirements are: 3.5 GPA overall, three letters of recommendation, and a statement of research.

Applicants' proposed statement of research must clearly align with the research strengths of existing faculty members. All applicants are strongly encouraged to contact individual faculty members (in person, by phone, or by email) to discuss their research interests and to identify potential advisors, as they will need a faculty member to sponsor them for admission.

In general, the Department admits between 5-10 students each year into the combined BS/MS program. There is no Departmental funding available.

Application Deadlines

Fall:
Applications for the PhD program must be received by January 15 (**December 15 preferred**) .
Applications for the MPS GIS program accepted up until August 1 .
Spring:
There is no spring entry, unless unpredictable circumstances preclude fall entry. Graduate director must approve it. .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Ph.D. Program

Admission into the program is strongly competitive. Students may be admitted with either an undergraduate or masters level degree. Minimum requirements are: GPA B (3.0) average in junior and senior year; GRE verbal 160 and quantitative 151; three letters of recommendation, preferably from academic reviewers. For international students, the following additional minimum test scores apply: Test of English as a Foreign Language (TOEFL) [internet-based test total 100]. International students who are applicants for teaching assistantships must also pass an International Teaching Assistant Oral Evaluation by the University's Maryland English Institute (MEI).

Closing date for applications into the Ph.D. program is **December 15**. Applications are reviewed from December to February for Fall entry; there is no Spring entry. The Graduate School will accept applications up to May 1 for certain visa categories. However, applications received by the Department after December 15 have a reduced chance of being considered for Fall entry and financial aid. The following are required for application into the program:

1. GRE General
2. 3 Letters of Recommendation
3. Undergrad and Grad transcripts
4. Statement of Goals and Research Interests and Statement of Experiences
5. International applicants: TOEFL or IELTS (also MEI oral exam for TAs)

In addition we strongly encourage the following: evidence of contact with faculty members, an example of writing or scholarship, and a current CV.

B.S./M.S. Program

Closing date for graduate school applications into the combined Bachelors of Science and Masters of Science program is **October 1**. Applications are reviewed from November to February for Fall entry; there is no Spring entry. The following are required for application into the program:

1. 3 Letters of Recommendation
2. Undergrad transcripts
3. Statement of Goals and Research Interests and Statement of Experiences

In addition we strongly encourage the following: evidence of contact with faculty members, an example of writing or scholarship, and a current CV.

Degree Requirements

Doctor of Philosophy (Ph.D.)
The study program is individually designed by the student and a faculty committee. One introductory course (3 cr), attendance at 3 Departmental Seminars (3 cr), quantitative or qualitative methods (3 cr), portfolio assessment (1-3 cr), pre-candidacy reseearch (min. 3 cr), optional elective courses, a dissertation proposal defense, a minimum of 12 dissertation credits after advancement to candidacy, and a dissertation. For those enterinig with a masters degree in geography, the PhD should be completed withing 4 years; For those entering with batchelors or without a geography background, the PhD should be completed within 5 years. Part-time study takes longer, but at least 1 year full-time attendance is required. Students entering with a B.A. or without a Geography background will take one course each in the following areas: Human, Physical, and Methods. See the PhD Handbook for further details.

Master of Professional Studies in Geospatial Information Sciences (M.P.S.G.I.S.)
Degree requirements are on the MPS GIS Web Site and in the MPS GIS Grad Catalog.

Combined Bachelors of Science and Masters of Science (BS/MS.) (B.S./M.S.)
The combined BS/MS degree is only granted to students who have successfully completed the 120 hours of undergraduate coursework, 30 hours of graduate coursework, and a scholarly paper. For more information in the course sequencing and credits applicable to both the undergraduate and graduate degrees, see the Department's website: www.geog.umd.edu.

Facilities and Special Resources

The Washington, D.C. metropolitan area is an exceptional location in which to pursue geographic research. Many national and international agencies are within a short distance of the campus, including the NASA Goddard Space Flight Center, the USDA Beltsville Agricultural Research Center, the National Archives, Bureau of the Census, National Institutes of Health, USGS, National Geospatial Imaging Agency, Smithsonian Institution, and NOAA. International and non-governmental agencies are located within easy reach, including the National Geographic Society, the Nature Conservancy, World Wildlife Fund, World Bank, and many others. Corporations, businesses and nonprofit organizations that use geographical applications are also well represented. Libraries on campus and nearby are unrivaled elsewhere in the world. The University is also located in a region of extraordinary geographic diversity, including two major urban centers (Baltimore and Washington, D.C.), and the superb, continuous section from the Appalachian mountains, through the Piedmont, Coastal Plain, and Chesapeake Bay to the Atlantic Coast.

Many opportunities exist for students to participate in externally funded research projects. Graduate students find these research programs a rich source of ideas for dissertations

as well as providing opportunities to join projects as paid research assistants and, often, identifying openings for employment on completion of their studies.

The Department is housed in over 35,000 sq. ft. on the main College Park campus. Teaching laboratories include facilities for cartography, GIS, and the Turner laboratories dedicated to computer-based instruction, while other facilities needed for virtually any type of investigation are available through collaborations with other departments. There are two primary computer environments, namely PC and UNIX, with over 100 machines dedicated to teaching and graduate research. The research laboratories support UNIX, Linux, and high-end PC machines, including very high performance processors and peripherals and large volume RAID arrays. There are a large number of printers, magnetic disk farms, tape libraries, etc. An extensive range of software is available, including satellite data processing, image analysis, and ESRI GIS packages. Field research, remote sensing, global positioning systems, and other types of equipment are available.

Financial Assistance

Teaching Assistantships, Research Assistantships, and various Fellowships are available. Salary is for 9.5 months per year. Assistants work 20 hours per week. Fellowship recipients have no work assignment. Depending upon resources, the department will provide up to four years of funding, provided the student meets the department's benchmarks (see the PhD Handbook). Applications are made on the University Graduate Admission Application and further information about Financial Aid is given in the Application. Note, residents of certain Southern States without equivalent Geography graduate programs may be eligible to receive tuition at the lower, in-state fee rates.

Funding is not available for students in the combined BS/MS program.

Contact Information

More detailed information on the MPS and Ph.D. programs can be obtained by reviewing the Department's Graduate Programs Program Web Site. Call or e-mail Assistant Director of Academic Programs for more information. To arrange consultations with the Graduate Director and individual faculty, call the Department at (301)-405-8085.

Assistant Director of Academic Programs
2181 LeFrak Hall
MD 20742
Telephone: (301) 405-8085 or (301) 405-9149
Fax: (301) 314-9299
crossgro@umd.edu rberndts@umd.edu

http://www.geog.umd.edu/

Courses: GEOG

Related Programs and Campus Units

Geospatial Information Sciences

Geography/Library & Information Systems (GELS)

Faculty:

Abstract

This dual degree program is no longer accepting applications.

Admissions Information

Application Deadlines

Fall:
This program **does not** accept applications for this semester.
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Degree Requirements

Financial Assistance

Courses: LBSC GEOG

Geology (GEOL)

Abstract

The Department of Geology offers programs leading to the M.S. and Ph.D. degrees. On a full time basis, the M.S. normally requires two to three years of work, which includes courses, the completion of an M.S. research thesis, and an oral defense of the thesis. On a full time basis, the Ph.D. commonly requires three to four years of work, if conducted after the completion of an M.S. program, or four to five years from the time of admission if pursued directly from the Bachelor level. The Ph.D. program normally includes course work, a qualifying examination and proposal defense, a dissertation, and an oral defense and examination of the dissertation.

Our students are required to engage in independent and original research under a mentoring program that promotes creative thinking. This is most commonly achieved via the collaboration between students and faculty in ongoing research programs. Geology is concerned with the Earth, its origin and evolution and the origin of life, and the processes by which Earth's atmosphere, surface and interior have been and continue to be modified. To pursue these topics we have developed research strengths in four themes: Geochemistry, which involves investigations of low- to high-temperature processes operating from Earth's surface to it's core and within the Solar System; Solid Earth Science, which is the study of the minerals, rocks, and structures that constitute Earth, and the tectonic and other processes by which they are formed and altered; Surficial Processes and Environments, which involves the study of active and past fluxes (and reservoirs) of water, dissolved components, and sediment on Earth's surface and the interactions of these fluxes with the biosphere and atmosphere; and, Geophysics, which includes investigations of Earth's interior structure and dynamics, as well as planetary physics. These areas are not mutually exclusive, and students are encouraged to develop a program that suits their interests. Developing areas within the Department include planetary geology and forensics.

Although students will choose an advisor within the Department of Geology, they may also wish to take advantage of research opportunities provided by collaboration with other departments on campus, such as Mathematics, particularly the Applied Mathematics and Scientific Computation Program (AMSC), Atmospheric and Oceanic Science, Physics, Geography, and Chemistry, as well as other institutions in the area including the Smithsonian Institution, United States Geological Survey, NASA, Department of Terrestrial Magnetism, Geophysical Lab and National Institute of Standards and Technology. The Earth System Science Interdisciplinary Center is a collaborative venture between the Departments of Geography, Geology and Atmospheric and Ocean Science on Campus, and the Earth Sciences Directorate at NASA Goddard.

Faculty:

Chair
Rudnick, Roberta L.
Walker, Richard J.

Professor
Brown, Michael
Candela, Philip A.
Farquhar, James
Kaufman, Alan Jay
Lathrop, Daniel P.
McDonough, William F.
Wylie, Ann G.

Associate Professor
Evans, Michael N.
Montesi, Laurent G. J.
Penniston-Dorland, Sarah
Prestegaard, Karen L.
Zhu, Wenlu

Assistant Professor
Kaushal, Sujay S.
Lekic, Vedran
Schmerr, Nicholas

Senior Research Scientist
Piccoli, Philip Michael

Associate Research Scientist
Puchtel, Igor S.

Assistant Research Scientist
Ash, Richard

Adjunct Professor
Bohlke, John K.
Sorenson, Sorena

Adjunct Associate Professor
Campbell, Andrew
Cottrell, Elizabeth

This wealth of in-house and collaborative resources positions our graduate students with an unmatched spectrum of opportunities and gives them access to a strong multi-disciplinary program of international stature.

Our current student demographics are diverse, with an approximate 50:50 mix of male and female students of which 10-20% are minority students. Approximately 60% of our graduate students are Ph.D. candidates (the remaining are M.S. students), and some of the M.S. students will petition to become Ph.D. candidates following the successful completion of their M.S. degree program. Other M.S. candidates are focused solely on the M.S. degree, which is the commonly held degree for practicing professionals in government and industry.

Our graduate students benefit from the opportunities of working within an advanced graduate program. Our graduates go on to distinguished post-doc, research and applied positions in academic, government and industrial settings. We proudly acknowledge having placed our students into prestigious post-doc positions and government laboratories and we highlight their publications (see http://www.geol.umd.edu/pages/graduates/gradpubs.htm), presentations at national and international meetings (see http://www.geol.umd.edu/pages/graduates/gradpresentations.htm) and awards (see http://www.geol.umd.edu/graduates/gradfunding.htm).

Admissions Information

Qualified students with a B.S. degree in geology, physics, mathematics, chemistry, biology, engineering or other related sciences are invited to apply for admission to the graduate programs. Our graduate degree program in geophysics welcomes students with undergraduate degrees in physics and or astronomy having little to no background in geology. Coursework expectations for students applying to the program is at least a year of calculus, a semester of physics for science majors, and for those in the in geology and geochemistry track a year of chemistry or its equivalent. All students must submit the Graduate Record Examination scores to be considered for admission.

Application Deadlines

Fall:
Applications must be received by March 15 (**January 15 preferred**) .
Spring:
Applications must be received by October 1 (**October 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE-Required
2. Three letters of recommendation

Degree Requirements

Master of Science (M.S.)

The Department of Geology offers a Master of Science degree. There is no single prescribed curriculum. Although 24 credit hours of course work and 6 credit hours of thesis research are required, the entire course of study is individually developed for each student by his/her graduate program committee as approved by the Director of Graduate Studies. The M.S. degree is awarded following the successful completion of the course requirements, defense of a proposal, submission of a satisfactory thesis, and an oral defense of the thesis. The M.S. normally requires two years of work.

Adjunct Assistant Professor
Shahar, Anat

Affiliate Professor
Busalacchi, Antonio J.
Helz, George R.
James, Bruce R.
Murtugudde, Ragu
Rudnick, Roberta L.

Affiliate Associate Professor
Zeng, Ning

Senior Lecturer
Holtz, Thomas R., Jr.

Lecturer
Merck, John W., Jr.

University Affiliate
Alexander, Conel
Arevalo, Richard
Beaulieu, Jake
Dye, Stephen
Fei, Yingwei
Gaetani, Glenn A.
Glaze, Lori S.
Larsen, Laurel
Lorrey, Andrew
McCoy, Timothy
Ono, Shuhei
Patterson, Gerald Wesley
Righter, Kevin
Roberts, James
Sauber, Jeanne
Shirey, Steven
Siddoway, Christine
Smith, Deborah K.
Stifel, Peter
Tominaga, Masako
Wagner, Lara
Watters, Thomas
Xiao, Shuhai

Professor Emerita
Wylie, Ann G.

Professor Emeritus
Stifel, Peter

Doctor of Philosophy (Ph.D.)

Students who have an M.S. degree must normally complete a minimum of 12 credits of coursework applicable to a graduate degree with at least 9 credits at the 600 level or above. Coursework requirements for students who do not hold an M.S. degree will be established by the Director of Graduate Studies after discussion with the student's advisor but normally will be 30 credits of coursework applicable to a graduate degree, 21 of which must be at the 600 level or above, and normally 24 credits must be from the Department of Geology, or in the case of an interdisciplinary study, an appropriate program approved by the Director of Graduate Studies. The Ph.D. degree requirements include satisfactory completion of course work, defense of a research proposal, an oral candidacy and research proposal examination, and a successful dissertation defense. The Ph.D. commonly requires three to four years of work, if conducted after the completion of an M.S. program, or four to five years from the time of admission if pursued directly from the bachelor level.

Facilities and Special Resources

The Department maintains a suite of state-of-the-art facilities and equipment for research, including: three solid source mass spectrometers, six gas source mass spectrometers, with inlet devices for inorganic and organic isotope analyses, single and multicollector inductively-coupled plasma mass spectrometers (ICP-MS), three UV lasers for in situ analyses with gas-source and plasma mass spectrometer, two chemical clean labs, with ion chromatographic facilities, JEOL 8900 superprobewith an Oxford instrument mini-cathodoluminescence detector, Scanning and Transmission Electron Microscopes, color image analysis system, fluid inclusion stage, high temperature and high pressure equipment for dry or hydrothermal experiments, diamond anvil cell facilities, including laser heating and external heating, two triaxial deformation apparatii with flow through capacity and acoustic emission recording, flame and graphite furnace atomic absorption equipment, spectrophotometers, HPLC with fluorescence detector, UV lamps and monochronometer for photochemistry, anoxic chamber, Geographic Information Systems (GIS) computational laboratory, electromagnetic and acoustic doppler velocity meters, laboratory and field hydrogeology equipment, campus drill rig, microstructures and fabrics analysis instruments, research microscopes with reflectance capabilities, rock preparation and mineral separation laboratories, computer network with direct access to supercomputer facilities, nitrogen Permeameter 400, helium Porosimeter 300, Solaris Impedance Meters.

Further information is found at the following URL http://www.geol.umd.edu/labs.htm

Financial Assistance

Graduate students are eligible for Departmental teaching assistantships, Graduate School fellowships and grant-supported fellowships and research assistantships. In addition, some curatorial, library and other part-time work is sometimes available.

Contact Information

See the Department of Geology Web page at URL http://www.geol.umd.edu for additional information. The Department's Graduate Studies in Geological Sciences also provides additional information on the requirements, examinations, faculty research interests and publications, research facilities and financial aid. Copies are available from:

Graduate Coordinator
1118 Geology Building, University of Maryland, College Park
MD 20742
Telephone: (301) 405-4065
geolgrad@deans.umd.edu

http://www.geol.umd.edu/

Courses: GEOL

Related Programs and Campus Units

Applied Mathematics & Statistics, and Scientific Computation

Geospatial Information Sciences (MPGS)

Faculty:

Acting Associate Dean
Lim, Eunjung

University Affiliate
Ma, Jianguo
Resop, Jonathan
Zhou, Naijun

Abstract

The Master of Professional Studies in Geospatial Information Sciences Program is dedicated to providing the most up-to-date training on geospatial technology, theory and applications. The courses cover spatial analysis, remote sensing, spatial statistics, modeling, programming and scripting, spatial databases, Internet GIS, and Mobile GIS. Both MPS degree and Graduate Certificate in GIS are offered.

In the program, all the classes are offered in real classrooms or GIS labs and at the same time broadcast online. For the online teaching, it is interactive and dynamic through webcam and headset very much like sitting in a real classroom. In addition, entire lectures (lecture slides, presentation, and Q&A interactions) are video-archived for reviewing. All courses are scheduled in the evenings (5:30-8:00pm) to accommodate working professionals.

Our program is one of the ESRI Development Centers.

Admissions Information

The Graduate School requires all admitted graduate students to have a baccalaureate degree from a regionally accredited college or university in the United States, or the equivalent of a baccalaureate degree in another country. A GPA of 3.0 is normally required for admission into this program. Applicants with an undergraduate GPA of less than 3.0 may be admitted on a provisional basis.

Applicants with foreign credentials must submit academic records in the original language with literal English translations.

Application Deadlines

Fall:
The application deadline is January 15 for International students and March 15 for U.S. citizens and permanent residents. However, if the domestic applicants have already met the prerequisites, they can apply as late as August 15. (**August 1 preferred**) .

Application Requirements

1. Graduate Application form
2. Transcripts from all universities/colleges attended
3. Cover letter or personal statement
4. C.V. or resume
5. Two recommendation letters
6. GRE is not required

Degree Requirements

Graduate Certificate (GC)
Students choosing the Graduate Certificate track need to complete 12 credit hours of approved coursework with an average grade of B.

Master of Professional Studies (M.P.S.)
Students choosing the Master of Professional Studies degree track need to complete 31 credit hours of approved coursework with an average grade of B.

Facilities and Special Resources

All registered students have full access to the facilities and resources (e.g. libraries, gym, computer labs) on campus just like any other traditional student. Students also have full access to the resources (e.g. computer labs, software applications, seminars, etc) in the Geographical Sciences Department as regular graduate students. The program has a dedicated lab for its students as well where they can study or take lectures in a real environment if they want to.

Financial Assistance

There are no fellowships available in this program. However, there are potential Teaching Assistantships available depending on the student's qualification.

Contact Information

Email: geog-gis@umd.edu Phone: 301-405-3861

Dr. Jianguo (Jack) Ma, Program Director
University of Maryland Department of Geographical Sciences 1133 LeFrak Hall
MD 20742
Telephone: 301.405.3861
Fax: 301.314.9299
jma3@umd.edu

http://www.geog.umd.edu/gis

Courses: GEOG

Related Programs and Campus Units

Geographical Sciences

German Literature and Language (GERS)

Abstract

The German Program of the Department of Germanic Studies offers graduate study leading to the M.A. and Ph.D. degrees. The main focus is on Modern German Studies combining both discipline-based and interdisciplinary courses. The intellectual focus of the degrees is German-speaking Europe from the Enlightenment to the present, as represented in literary and non-literary texts, and other cultural productivity.

The degrees reflect the paradigm shift within the field of German language and literature expanding the focus of Germanistik to a broader concentration on cultural studies which include gender studies, film studies, and postcolonial theory.

Faculty:

Graduate Director
Hester Baer

Professor
Beicken, Peter U.
Frederiksen, Elke P.
Moyer, Alene
Oster, Rose-Marie G.

Associate Professor
Hester Baer
Koser, Julie

A concentration in Medieval Studies is also offered on an interdepartmental basis.

Admissions Information

In addition to the Graduate School requirements, candidates should have a bachelor's degree with a major in German language and literature or the equivalent, and fluency in the written and spoken language. Candidates for the doctorate must have a master's degree in German or in a related discipline such as Germanic studies, Scandinavian studies, language education, and Medieval studies. The Program is seeking approval to allow candidates with a BA to enter the Ph.D. Program earning the M.A. on the way.

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
Applications must be received by October 15 (**October 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. No Tests
2. 3 Letters of Recommendation
3. Writing Sample
4. Oral Interview (in person or by phone) with Graduate Director

Degree Requirements

Master of Arts (M.A.)

The M.A. degree program offers both a thesis and non-thesis option. For the thesis option, the student must complete 24 hours of coursework, the thesis with oral defense and a written comprehensive examination. The non-thesis option requires 30 hours of coursework, a mini-thesis with oral defense and a written comprehensive examination. For both options the comprehensives consist of two three-hour examinations based on the coursework and the M.A. reading list.

Doctor of Philosophy (Ph.D.)

Degree requirements for the Ph.D. are as follows: 1) completion of at least 24 hours of coursework beyond the master's degree over a period of at least one year at the University of Maryland and a further 12 hours of dissertation research; 2) a reading skill examination in a language other than English or German, which may be another Germanic language or a language related to the candidate's research; 3) comprehensive written examinations; 4) presentation of the dissertation, an original study in the field of specialization on a topic approved by the advisor and the examining committee; and 5) the oral defense of the dissertation (one to two hours).

Facilities and Special Resources

In addition to its course offerings listed below, the German Program of the Department of Germanic Studies sponsors the German Club, the University of Maryland Chapter of Delta Phi Alpha (the national German language honors society). The department participates in the University Honors Programs and has a departmental honors program. Distinguished scholars and lecturers as well as visiting professors visit the metropolitan area and campus regularly. College Park's proximity to Washington, D.C., facilitates participation in the many cultural functions of the capital with its wealth of German and Scandinavian social groups and national societies: the Embassies of Austria, Denmark,

Professor Emeritus
Herin, Christoph A.
Pfister, Guenter G.

Associate Professor Emerita
Strauch, Gabriele L.

Associate Professor Emeritus
Walker, Richard E.

Germany, Norway, Sweden, Switzerland; the German Historical Institute, and the Goethe Institute.

Financial Assistance

The German Program offers graduate fellowships and teaching assistantships, and the Graduate School offers, on a competitive basis, fellowships, and grants.

Contact Information

For further program information please contact:

Dr. Hester Baer
Associate Professor & Graduate Director
Dept. of Germanic Studies
School of Languages, Literatures and Cultures
University of Maryland
3225 Jimenez Hall
College Park, MD 20742
Telephone: 301-405-4101
hbaer@umd.edu
http://sllc.umd.edu/german

For general inquiries please contact:

Josiland Chambers
Graduate Coordinator
School of Languages, Literatures, and Cultures
1104 Jimenez Hall
College Park, MD 20742
Telephone: 301-405-6021
jchamb@umd.edu

Courses: GERM

Global Health (Z070)

Faculty:

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Abstract

The Graduate Certificate in Global Health is designed to provide basic knowledge in global health delivery to those employed or seeking employment in positions requiring this knowledge or to individuals who desire this added credential. The Global Health Certificate provides knowledge of issues, policies, and practices in global health that enables individuals (many of whom do not have public health backgrounds) to work effectively in agencies and programs providing global health services. As an area for study, research, and practice, global health emphasizes translational health issues, synthesizing population-based prevention with evidenced based, community supported initiatives.

The Global Health Certificate requires completion of four courses (12 credits), three of which are required and a fourth of which is an elective. The core curriculum includes foundational aspects of global health, communication and promotion, and program planning and evaluation. The elective topics include history, diplomacy and/or social marketing in Public Health. A blended learning format featuring seminar-style, face-to-face instruction and online learning is offered at the College Park campus.

The Global Health Certificate is offered through the University of Maryland's School of

Public Health, a leader in the discovery, application, and dissemination of public and global health knowledge in the state of Maryland, the nation, and the world. The School of Public Health has specifically targeted programs, curricula, service and research dedicated to the understanding and improvement of global health.

Admissions Information

For Application Instructions, please visit: http://oes.umd.edu/professional-programs/global-health/gh-admission-information

UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS). For additional requirements, please see: http://oes.umd.edu/professional-programs/global-health/gh-admission-information#international

All application materials must be received by the deadlines below.

Fall semester: by June 1

Spring Semester: by December 1

Application Deadlines

Application Requirements

Degree Requirements

Global Health (Graduate Certificate)

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/global-health

Courses:

Government and Politics (GVPT)

Abstract

The Department of Government and Politics offers a Ph.D. degree in political science, intended primarily for those planning academic careers. Students can specialize in American politics, comparative politics, international relations, and political theory. In addition, students can study in depth more specialized fields such as public law, national security, public policy, political psychology, international and inter-ethnic conflict, international political economy, urban politics, post-Soviet and post-communist studies,

Faculty:

Associate Dean
McIntosh, Wayne V.

Chair
Morris, Irwin L.

Distinguished Scholar-Teacher
Glass, James M.
Quester, George

East-Asian studies, environmental politics, and the politics of advanced industrial societies.

Admissions Information

The Department recruits highly qualified students, and admits only a limited number of the strongest applicants. The Admissions Committee rarely grants provisional or conditional admission to the graduate program. The Department does not usually admit M.A. applicants. Only students whose ultimate objective is the Ph.D. should apply for direct admission to that program. Admission is granted only for the Fall Semester.

Application Deadlines

Fall:
Applications must be received by February 1 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Writing Sample
4. statement of purpose
5. transcripts

Degree Requirements

Doctor of Philosophy (Ph.D.)

The doctoral program is intended to provide students with the knowledge, methodological skills and research experience appropriate for persons who intend to enter the discipline of political science. Students must complete 42 hours of graduate work including courses in political theory and research methods and pass written comprehensive examinations in two fields. Although formal coursework and field examinations are important components of the doctoral program, the research component, especially in the form of the dissertation is paramount. Consequently students who are able to demonstrate an interest in quality research activities and desire to become creators as well as consumers of knowledge are appropriate for the doctoral program.

Master of Arts (M.A.)

Master of Arts (M.A.) The graduate program in the Department of Government and Politics is designed for doctoral students. Except for students participating in our dual-degree program with the United States Naval Academy, we do not accept students for the sole purpose of acquiring a Master's degree. Doctoral students may obtain a Master of Arts Degree during their course of doctoral study once they have satisfied the requirements associated with the Master's degree.

Facilities and Special Resources

Graduate students in the department participate in the activities of the Public Service Intern Program, Project ICONS, the Center for International Development and Conflict Management, the Center for the Study of American Politics and Citizenship, the Center for the Study of Post-Communist Societies, The Committee on the Political Economy of the Good Society, and the Harrison Program on the Future Global Agenda.

Financial Assistance

Tismaneanu, Vladimir
Wilkenfeld, Jonathan

Professor
Alford, Charles F.
Gimpel, James G.
Glass, James M.
Huth, Paul K.
Lichbach, Mark I.
Lichbach, Mark I.
McIntosh, Wayne V.
Morris, Irwin L.
Pearson, Margaret M.
Telhami, Shibley
Tismaneanu, Vladimir
Uslaner, Eric M.
Wilkenfeld, Jonathan

Associate Professor
Banks, Antoine J.
Birnir, Johanna
Cunningham, David
Cunningham, Kathleen
Hanmer, Michael J.
Haufler, Virginia Ann
Kaminski, Bartlomiej K.
Karol, David
Kastner, Scott L.
Lee, Frances E.
Rouse, Stella M.
Soltan, Karol E.
Swistak, Piotr T.

Assistant Professor
Alcaniz, Isabella
Allee, Todd
Bond, Kanisha
Croco, Sarah E.
Hadden, Jennifer
McKenzie, Brian D.
Miler, Kris
Ward, Ian
Wohlfarth, Patrick

University Affiliate
Bond, Kanisha

Professor Emeritus
Oppenheimer, Joe A.
Piper, Don C
Quester, George
Stone, Clarence N.

In addition to fellowships and teaching assistantships, the Department also has a public service intern program for students interested in State government. There are also a limited and variable number of research positions available.

Contact Information

Further information, including a manual on graduate study, please contact:

Director of Graduate Studies
3140 Tydings Hall
MD 20742
Telephone: (301) 405-4161
gvptgrad@deans.umd.edu

http://www.bsos.umd.edu/gvpt/

Courses: GVPT

Related Programs and Campus Units

Applied Mathematics & Statistics, and Scientific Computation

Graduate Certficate: Computational Harmonic Analysis (Z023)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate of Professional Studies -- Real Estate Development (Z029)

Faculty:

Abstract

The Graduate Certificate in Real Estate Development is a 12 - 21 credit program, depending on the work experience and academic preparation of the applicant. The Certificate is primarily designed for obtaining the introductory basics of real estate development for those who may not yet have determined to make their career in the field. However, the courses required may be adapted to prior experience or level of expertise for those who are looking for advanced work. The Certificate is comprised of the two fundamental courses for the Master's degree plus two cognate courses, as well as any courses (1 - 9 credits) that would be additional preparation as detailed in an admission letter. The basic and preparatory courses are all offered to Masters students as well, and

Certificate students are not in separate courses for either preparatory courses or for the RDEV (real estate development) courses.

Up to four courses taken as part of the Certificate may be counted toward the MRED degree upon completion of the certificate if the student applies and is accepted into the MRED degree program. Successful completion of the Certificate with grades of B or better assures admission to the MRED program. Up to additional 9 credits of leveling course work may be required before a Certificate student may move on to the core real estate certificate courses, depending on the background and experience of the applicant. Students subsequent to admission are subject to three assessments: of Excel Skills, Business Writing and Oral Presentation skills. Students who do not meet minimum standards in the Orientation assessments, or if determined during early coursework that skills are insufficient, a student may be required to take additional evening or weekend coaching courses in order to meet the Program's Professional Skills Standards.

Generally students take 6 credits (2 courses) per term, and can finish within a year if no additional leveling preparatory courses are required. For students required to complete a full 21 credits, may finish 15 months by taking classes through two summer sessions as well as 3 spring and fall terms. However, a student may, if they are not working, take a maximum of four courses per term. There is no guarantee that the four required courses, for the Certificate, however, will be offered in each term. There is more information about the courses and teaching methods used for the Graduate Certificate Real Estate Development sequence at the catalogue entry for RDEV -- Real Estate Development. There is also information on all the real estate graduate programs, including dual degrees available with historic preservation and architecture at the web site www.arch.umd.edu/real_estate_development.

Certificate students are not eligible to take elective RDEV courses or the Capstone course prior to admission to the Master's program. Certificate students may, on a space available basis, participate in Study Abroad courses, but not for credit towards the Certificate degree.

Admissions Information

Acceptance to the Certificate program is competitive. Applicants are required to have a minimum undergraduate grade point average (GPA) of 3.0 on a 4.0 scale from an accredited University. Applicants who demonstrate a strong interest and aptitude with a GPA below 3.0 may be considered on a case by case basis if they show a strong aptitude and/or experience in the field. Such applicants are admitted provisionally based on meeting grade expectations in the program and often may require additional courses to be taken.

A GRE, LSAT or GMAT score is not required, but is preferred if the applicant's undergraduate degree was awarded less than 5 years previously.

No transfer credits from graduate work in other programs at the University of Maryland, or other academic institutions, are accepted towards the Certificate.

Incoming students are required to attend a two day Orientation and Assessment Program on the Saturday and Sunday before the beginning of the term in which they take their first course. Based upon Assessments of Professional Skills, additional coaching sessions on Saturdays or late afternoons (5:00 - 7:00pm) may be required for those who do not meet minimum skills in Excel, Business Writing and Oral Presentation. Fees may be charged for such courses, although currently the Colvin Institute covers the cost. Attendance at the Assessment sessions and any follow-up coaching is required to be awarded the Certificate, although the grading is on a pass/fail basis.

Application Deadlines

Fall:
Applicants for Fall 2011 and Fall 2012 must submit their application by March 15 March 15 (**February 1**

preferred) .
Spring:
Domestic Applications for Spring 2012 are accepted; Program is not available to International Applicants October 1 (**September 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Statement of Purpose
2. Transcript(s)
3. Letters of Recommendation (3)
4. CV/Resume

Degree Requirements

Graduate Certificate of Professional Studies -- Real Estate Developement (GCPS)
A 12 - 21 credit introductory program to real estate development. Recommended for those considering whether to move into the real estate development field full time. Courses may be applied to the Master of Real Estate Development Program, if a student desires to go on to full professional preparation

The 4 required courses of the Certificate are Development Law, Process and Ethics; Fundamentals of Development Finance, and two of the following: Principles of Urban Design, Essentials of Property Management, Planning Policy, and Construction Management. For students without academic preparation in finance, accounting and economics, additional leveling courses (1 - 9 credits) are required in those areas before proceeding to the 4 required courses.

Students may begin the Certificate program in either the Fall or Spring terms. Applications are reviewed and admission decisions issued on a rolling basis

Waivers of the deadline for domestic applicants are available may be available depending on the number of applicants already admitted.

Facilities and Special Resources

The Facilities and Special Resources available to RDEV (Master of Real Estate Development students) are generally available to Graduate Certificate students. Although, Certificate students may not participate in supported competitions, and financial aid may be more limited. Certificate students are not eligible to take the Capstone course, without applying and completing the Master's requirements. To read about the extent of the facilities and special resources available please check the catalogue of the RDEV program or the web site at www.arch.umd.edu/real_estate_development

Financial Assistance

Financial aid through the University administered federal loan programs is not currently available for Certificate students. Contact the Program Director after application as to any available Program scholarship assistance, which, depending on the term, may or may not be available for Certificate students. Scholarship awards from the Program are never available for Summer and Winter term courses or for Study Abroad.

Contact Information

You will find more information about the Graduate Programs in Real Estate Development at the University of Maryland at www.arch.umd.edu/real_estate_development

Margaret McFarland, JD, Director, Graduate Programs in Real Estate Development
University of Maryland School of Architecture, Planning and Preservation Building 145
College Park
MD 20742
mmcf@umd.edu

http://arch.umd.edu/rdev/graduate-certificate-real-estate-development

Courses:

Graduate Certificate: Neuroscience and Cognitive Science (Z037)

Faculty:

Abstract

The Neuroscience and Cognitive Science (NACS) Program offers a Post-Baccalaureate Certificate for students pursuing graduate degrees in related departmental programs. This certificate program allows students to obtain significant interdisciplinary training that complements their graduate degree in a NACS-related discipline. The NACS Certificate serves to acknowledge this training.

Admissions Information

Only students enrolled in a Ph.D. degree program at the University of Maryland, College Park will be eligible for the NACS Certificate. Students enrolled in the NACS Ph.D. program are not eligible. Interested students are encouraged to contact the NACS office for advisement on coordinating the NACS Certificate requirements with their Ph.D. requirements. Admission will be at the discretion of the NACS Graduate Director, with the advice and consent of the NACS Executive Committee. Students must submit a letter to the NACS Graduate Director requesting admission to the Certificate Program and outlining their plan of study for the NACS Certificate. Students must also identify a NACS faculty member to serve as their Certificate advisor. In many cases this may be the student's existing departmental Ph.D. advisor. Study for the Certificate must be completed by the end of the fifth year after admission to the program.

Application Deadlines

Application Requirements

1) Completed application to the NACS Certificate program. 2) PDF copy of unofficial UM transcript. 3) Letter from primary advisor endorsing the application to the NACS Certificate program. All files should be submitted electronically, with a strong preference for PDF files. Please use transparent file names that start with your name, i.e., smith_application.pdf, smith_transcript.pdf, smith_endorsement.pdf. Send files together in ONE email message to Pam Komarek, NACS Assistant Director, at pkomarek@umd.edu.

Degree Requirements

Certificate ()
Students must earn a minimum of 16 credits through completing the following courses with a grade of B (3.0) or better in each class. 1) Students must complete a core of 10 credits, in addition to their Ph.D. course requirements, comprising at least two of the courses within the NACS core curriculum (NACS641, NACS642, NACS643, NACS644, NACS728Y, all 4 credit courses) and two semesters of NACS 608, Neuroscience and Cognitive Science Seminar, one credit per semester. 2) Students must complete at least 6 additional credits from graduate courses approved by the NACS program. The student's NACS advisor and the NACS Graduate Director must approve the courses

taken to fulfill these credits. Courses taken at the 400-level require the approval of the NACS Graduate Director.

Financial Assistance

Contact Information

Assistant Director, Pam Komarek
University of Maryland, 2131 Biology-Psychology Building, College Park
MD 20742
Telephone: 301-405-8910
Fax: 301-314-9566
pkomarek@umd.edu

http://www.nacs.umd.edu/program/certificate.html

Courses:

Graduate Certificate: Scientific Computation (Z014)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Terrorism Analysis (Z039)

Faculty:

Abstract

The National Consortium for the Study of Terrorism and Responses to Terrorism (START) is dedicated to training and mentoring a new generation of scholars and analysts capable of examining questions related to the behavior of terrorists and terrorist groups and to the issue of how societies can best prepare for dealing with a terrorist threat or responding to a terrorist attack. START's Graduate Certificate in Terrorism Analysis provides participants with advanced education on the causes, dynamics and impacts of international and domestic terrorism. Participants also develop the methodological skills necessary to pursue advanced research on and analysis of terrorism. The program consists of four required courses. Each course is offered once per calendar year, in an online, synchronous learning environment. The program can be completed in as little as 9 months to 24 months.

The Program is appropriate for Individuals interested in (and/or currently) working in fields related to intelligence analysis, homeland security analysis, or analysis of other relevant topic areas; and Individuals interested in (and/or currently) conducting scholarly research on terrorism and responses to terrorism.

Admissions Information

Students may enter the program at two points throughout the year:

Fall - apply by July 1 (International applicants, June 1)

Spring - apply by November 1 (International applicants, October 1)

All application materials must be received by the deadlines as described above.

Application Deadlines

Fall:
Students may enter the program at three points throughout the year. .
Spring:
Students may enter the program at three points throughout the year. .
Summer:
Students may enter the program at three points throughout the year. .

Application Requirements

Eligible applicants must have earned a 4-year baccalaureate degree from a regionally-accredited U.S. institution, or an equivalent degree at a foreign university. A 3.0 GPA is preferred, but experience may substitute. GRE scores are not required. All applications must be submitted via the online application available at: www.gradschool.umd.edu/gss/admission.html

Applicants ARE required to complete the Application Supplemental Form. All applicants must provide:

1. **Transcripts for all university-level coursework**
2. **A personal statement**
3. **A resume**
4. **Two recommendations (professional or academic accepted)**
5. **One-time application fee of $75 to University of Maryland**

Degree Requirements

Graduate Certificate in Terrorism Analysis ()
The Certificate is earned by successful completion of all four of Graduate Certificate in Terrorism Anaylsis courses. These courses may be taken in any order although students must have successfully completed one other class before enrolling in BSOS 633 Research Methods in Terrorism Studies.

Graduate Certificate Courses

Terrorist Motivations and Behaviors (BSST 630)
(Fall semester)
Focuses on theories explaining the formation of terrorist groups and the motivations behind terrorist behavior.

Societal Impact of and Responses to Terrorism (BSST 631)
(Spring semester)
Examines ways in which different actors respond to both terrorist incidents and to the threat of terrorism.

Development of Counterterrorism Policy and Programs (BSST 632)
(Fall semester)
Explores counterterrorism policies and policy making processes and actors since 2001.

Research Methods in Terrorism and Counterterrorism (BSST 633)

(Spring semester)
Provides students with a basic understanding of the methods of quantitative research available to social scientists studying terrorism and counterterrorism.

Facilities and Special Resources

The START center at UMD has pulled from it's extensive experience in the field of terrorism research and analysis in order to formulated the Graduate Certificate curriculum with the intention of providing a well rounded and sophisticated approach to the subject matter. Students are drawn from both the academic and professional worlds bringing a range of perspectives to the virtual classroom helping to cultivate a stimulating learning environment.

Financial Assistance

START does not currently provide financial assistance to Graduate Certificate students.

Tuition

Initial application fee: $75
Tuition and fees per course: $2,100
Please note: Students are responsible for purchasing their own books, software, and other supplies as required by each instructor. Students may be required to pay additional UMD student fees.

Contact Information

To request a virtual information packet, set up a virtual information appointment, or receive information about an upcoming information session: please email Jacqueline DeVore at jldevore@umd.edu.

Education Coordinator: Jacqueline DeVore
National Consortium for the Study of Terrorism and Responses to Terrorism
8400 Baltimore Avenue, Suite 250

College Park
MD 20740
Telephone: 301-405-7019
Fax: 301-314-1980
education@start.umd.edu; jldevore@umd.edu

http://www.start.umd.edu/education/graduate-certificate-online

Courses: BSST

Graduate Certificate: Curation and Management of Digital Assets (Z093)

Faculty:

Dean
Preece, Jennifer J.

Professor
Marciano, Richard

Assistant Professor
Punzalan, Ricardo L.
Shilton, Katie

Abstract

The Curation and Management of Digital Assets (CMDA) Certificate is a post-master's program that focuses on instruction about and research into the creation, management, and use; the long-term preservation; and the current and future access to digital assets in a variety of disciplines and sectors of the economy. It is a four-course, fully online certificate designed for working professionals who need training in next-generation cloud computing technologies, tools, and resources to help them evaluate, select, and implement digital curation solutions.

In the Washington, D.C.-Maryland-Virginia region, across the nation, and around the world, the need for professionals to manage and curate digital assets is acute. Major corporations, government agencies, international organizations, universities, cultural heritage institutions, and scientific organizations need information professionals with the knowledge, skills, and abilities to manage, preserve, and curate digital resources.

Adjunct Professor
Johnston, Jesse

Visiting Professor
Kurtz, Michael

Admissions Information

Admission Requirements

All applicants to the College of Information Studies must meet the minimum requirements set by the University of Maryland Graduate School. These are:

- Applicants must have earned a four-year baccalaureate degree from a regionally accredited U.S. institution, or an equivalent degree from a non-U.S. institution.
- Applicants must have earned a minimum 3.0 GPA (on a 4.0 scale) in all prior undergraduate and graduate coursework.
- Applicants must provide an official copy of a transcript for all of their post-secondary work.
- The TOEFL or IELTS scores are required of international applicants who are not native speakers of English.

In addition, CMDA certificate applicants must also meet the following criteria to be considered:

- Master's degree in library or information science; or master's degree in a related area and relevant experience.
- Certificate must be pertinent to applicant's current position.

Application Submission Requirements

All application materials are submitted electronically through the Graduate School's ApplyYourself/Hobsons application system. To ensure the integrity of the application process, the University of Maryland authenticates submitted materials through TurnItIn for Admissions. The electronic submission of application materials helps expedite the review of an application. Completed applications are reviewed by the Professional Education Committee at the iSchool. The recommendations of the committee are submitted to the Graduate School, who will make the final admission decision.

Application Submission Requirements for International Graduate Students

The University of Maryland is dedicated to maintaining a vibrant international graduate student community. The office of International Students and Scholars Services (ISSS) is a valuable resource of information and assistance for prospective and current international students. International applicants are encouraged to explore the services they offer and contact them with related questions. Please

also visit the Graduate Admissions Process for International applicants for more information.

Help with the Application

Those who have begun the application process are encouraged to contact the Hobson's helpdesk for any technical issues. Students who have not started the application process should direct questions related to the ApplyYourself application process to the Graduate School.

Application Deadlines

Application Requirements

The following materials must be submitted for acceptance:

- Graduate School Application
- Transcripts
- Current resume or CV
- A Statement of Purpose (500 words) about the applicant's interest and how the certificate will contribute to the applicant's career
- One (1) letter of recommendation from a supervisor or someone who can speak to the applicant's capacity for successfully completing the certificate program and how the certificate will contribute to the applicant's career

Degree Requirements

Graduate Certificate: Curation and Management of Digital Assets (Cert)
The Curation and Management of Digital Assets (CMDA) Certificate is a post-master's program that focuses on instruction about and research into the creation, management, and use; the long-term preservation; and the current and future access to digital assets in a variety of disciplines and sectors of the economy. It is a four-course, fully online certificate designed for working professionals who need training in next-generation cloud computing technologies, tools, and resources to help them evaluate, select, and implement digital curation solutions.

The CMDA Certificate requires the completion of four courses, with a minimum 3.0 GPA. The following courses are taken in sequence within one calendar year.

- INST 640: Principles of Digital Curation (3 credits)
- INST 641: Policy Issues in Digital Curation (3 credits)
- INST 742: Implementing Digital Curation (3 credits)
- INSTXXX: Solving Problems in Digital Curation (3 credits)

Financial Assistance

The first cohort of certificate students (up to 15 students beginning the certificate program in June 2015) will receive full tuition remission* through scholarships provided by an Institute of Museum and Library Services (IMLS) grant. Future certificate cohorts are not expected to receive financial assistance at this time. *Students will be responsible for paying fees.

Contact Information

For more information, please visit http://ischool.umd.edu/content/cmda-certificate.

Tricia Donovan, Coordinator of Professional Education
College of Information Studies

Hornbake Building South, Room 4105

University of Maryland

College Park
MD 20742
Telephone: 301-405-0366
Fax: 301-314-9145
cmda-cert-info@umd.edu

http://ischool.umd.edu/content/cmda-certificate

Student Services Office
College of Information Studies

Room 4110, Hornbake Building South

University of Maryland

College Park

MD 20742
Telephone: (301) 405-2038
Fax: (301) 405-9145
ischooladmission@umd.edu

Courses: INST

Graduate Certificate: Engineering (Z013)

Abstract

The Graduate Certificate in Engineering (GCEN) Program is a highly-focused practice oriented, part-time graduate program designed to assist engineers and technical professionals in the development of their careers and to provide the technical expertise needed in the rapidly changing business, government, and industrial environments. The program is intended for individuals who may already have an advanced degree (e.g. a master's or doctoral degree) and do not find a full masters degree program an appropriate option, and it offers integrated sets of core/elective courses from all of the engineering departments. Late afternoon, evening, and online classes are taught by full-time faculty and experienced adjunct faculty at the campus in College Park and at designated learning centers throughout Maryland.

Options are available in the following engineering disciplines:

- Aerospace Engineering
- Bioengineering
- Chemical and Biomolecular Engineering
- Civil and Environmental Engineering

Faculty:

Executive Director
Syrmos, George

Advisor
Bergbreiter, Sarah E.
Bruck, Hugh A.
Chung, Peter
Cukier, Michel
Fourney, William L.
Haghani, Ali
Herold, Keith E.
Kalantari Khandani, Mehdi
Klauda, Jeffery
Memon, Atif M.
Milke, James A.
Qu, Gang
Takeuchi, Ichiro
Trouve, Arnaud
Vaughn-Cooke, Monifa

- Electrical and Computer Engineering
- Energetic Concepts*
- Environmental Engineering
- Fire Protection Engineering*
- Materials Science and Engineering
- Mechanical Engineering
- Nuclear Engineering*
- Project Management*
- Reliability Engineering*
- Software Engineering
- Systems Engineering
- Technology Ventures and Entrepreneurship

* available 100% online

Admissions Information

The Graduate Certificate in Engineering (GCEN) Program is open to qualified applicants holding a regionally accredited baccalaureate degree in engineering or a related field. In addition to submitting a Graduate School admission application with fee, a copy of the applicant's college transcripts is required for evaluation. Applicants with an undergraduate GPA of less than 3.0 may be admitted on a provisional basis if they have demonstrated a satisfactory experience in another graduate program and/or their work experience has been salutary. In that case, two recommendation letters are required as well. Applicants with foreign credentials must submit academic records in the original language with literal English translations. Please allow at least three months for evaluation of these credentials. We trust that you will find this 12 credit-hour program to be an affordable, convenient way to "retool" and keep current with the latest technological developments in your field, or perhaps to develop a new area of expertise so as to further your career.

Application Deadlines

Fall:
We cannot admit international applicants for this program. Domestic applications must be received by August 15 (**August 1 preferred**) .
Spring:
We cannot admit international applicants for this program. Domestic applications must be received by January 10 (**December 15 preferred**) .
Summer:
We cannot admit international applicants for this program. Domestic applications must be received by May 15 (**May 1 preferred**) .

Application Requirements

1. Bachelor's degree in engineering or a related field 2. GRE not required 3. College transcripts 4. If GPA is below 3.0, two recommendation letters are required 5. Graduate school admission application fee 6. In online application, select Graduate Certificate in Engineering as the major.

Degree Requirements

Facilities and Special Resources

Courses in the Graduate Certificate in Engineering program are currently offered on the College Park campus, are available at off-campus centers, via

Distance Education Technology and Services (DETS), which is a live interactive distance education system, and 100% online. Courses are available via DETS at the University of Maryland System Shady Grove Center in Montgomery County, the Higher Education and Applied Technology (HEAT) Center in Harford County, the Southern Maryland Higher Education Center in St. Mary's County, Frostburg State University in Allegany County, and University System of Maryland at Hagerstown in Washington County.

Financial Assistance

There are no assistantships or fellowships available in this program.

Contact Information

For more specific information, contact:

Dr. George Syrmos, Executive Director
2105 J.M. Patterson Building, University of Maryland, College Park
MD 20740
Telephone: 301-405-0362
Fax: 301-405-3305
oaee@umd.edu

www.oaee.umd.edu

Ms. Vinette Brown-Darlington, Assistant Director for Academic Outreach
2105 J.M. Patterson Building, University of Maryland, College Park
MD 20740
Telephone: 301-405-1098
Fax: 301-405-3305
oaee@umd.edu

www.oaee.umd.edu

Courses: ENPM

Related Programs and Campus Units

Engineering: Aerospace Engineering
Engineering: Bioengineering
Engineering: Chemical Engineering
Engineering: Civil and Environmental Engineering
Engineering: Electrical & Computer Engineering
Engineering: Fire Protection Engineering
Engineering: Materials Science and Engineering
Engineering: Mechanical Engineering
Engineering: Reliability Engineering
Engineering: Systems Engineering

Graduate Certificate: Historical Preservation (Z005)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Intermediate Survey Methodology (Z011)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Jewish Studies (Z018)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Large Scale Assessment (Z015)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Literacy Coaching (Z038)

Faculty:

Abstract

The Department of Curriculum and Instruction's (EDCI) literacy coach post-baccalaureate graduate certificate program is designed to prepare experienced, highly qualified middle and high school teachers to serve as literacy coaches in low performing middle and high schools. Literacy coaches are skilled content area collaborators who function effectively in middle school and/or high school settings for secondary teachers in the core content areas of English language arts, mathematics, science, and social studies. They are skilled evaluators of literacy needs within various subject areas and are able to collaborate with secondary school leadership teams and teachers to interpret and use literacy assessment data to inform instruction. Finally, literacy coaches are accomplished middle and high school teachers who are skilled in developing and implementing instructional strategies to improve academic literacy in the four targeted content areas. The program courses focus on a) reading, cognition, and instruction across content areas, b) diagnostic reading assessment and instruction, c) teaching ESOL reading and writing in secondary content areas, d) assessing, diagnosing, and teaching writing across content areas, e) TESOL, special education, and assistive technology, and f) coaching and mentoring teachers. In addition, literacy coach candidates participate in school district professional development workshops mapped onto the literacy coach coursework. The EDCI literacy coach program addresses the Standards for Middle and High School Literacy Coaches (International Reading Association, 2006). Upon successful completion of the literacy coach program, candidates receive a graduate literacy coach certificate from the University of Maryland.

EDCI Literacy Coaching Program Courses

EDCI 763: Reading, Cognition, and Instruction: Reading Across Content Areas (3 cr.)
EDCI 662: Diagnostic Reading Assessment and Instruction (3 cr.)
EDCI 646: Coaching and Mentoring Teachers: Literacy Across Content Areas (3 cr.)
EDCI 638: Teaching ESOL Reading and Writing in Secondary Content Areas (3 cr.)
EDCI 673: Assessing, Diagnosing, and Teaching Writing Across Content Areas (3 cr.)
EDCI 632: Special Education, TESOL, Assistive Technology: Reading and Writing (3 cr.)

Admissions Information

Application Deadlines

Application Requirements

- Applicants should be highly qualified middle or high school teachers.
- Typically, the application deadline is March 15.
- Contact Elizabeth Johnson and/or Wayne Slater in the Department of Curriculum and Instruction (EDCI) for additional information. Refer to their contact information included below for email addresses

and phone numbers. Email or phone contacts preferred. Please do not fax inquiries.

Degree Requirements

Graduate Certificate ()

Facilities and Special Resources

Please refer to the "EDCI Literacy Coaching OnLine Resources" available at http://www.education.umd.edu/EDCI/info/litcoach/.

Financial Assistance

Contact Information

Elizabeth E. Johnson, Program Management Specialist II
University of Maryland Department of Curriculum and Instruction (EDCI) 2311 Benjamin Building
College Park
MD 20742-1175
Telephone: (301) 405-3153
Fax: (301) 314-9055
ejohnson@umd.edu

http://www.education.umd.edu/EDCI/info/litcoach/index.htm

Dr. Wayne Slater
University of Maryland Department of Curriculum and Instruction (EDCI) 2311 Benjamin Building
College Park
MD 20742-1175
Telephone: (301) 405-3128
Fax: (301) 314-9055
wslater@umd.edu

Courses: EDCI

Graduate Certificate: Mathematics of Advanced Industrial Technology (Z022)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Population Studies (Z036)

Faculty:

Co-Director
Hellerstein, Judith K.
Kahn, Joan R.

Abstract

The Certificate Program in Population Studies provides interdisciplinary training in demographic methods, theory, and research for graduate students in departments affiliated with the Maryland Population Research Center (MPRC), culminating in a Certificate in Population Studies for graduate students who complete the required coursework. Historically, the Population Sciences were born out of the discipline of Demography, a field that boomed during the 1950s around fears of a world-wide population explosion and its consequences. Demography was taught largely within departments of Sociology. Today the field has changed a great deal and researchers worry about issues of low fertility and underpopulation as much as overpopulation. What demographers of the 1950s missed in their dire predictions were unprecedented behavioral changes of families to changing economic circumstances, changing social pressures, and changing ideas of what constituted a family. Today, the core of the population sciences is not forecasting population growth and its components (mortality, fertility and immigration) but instead understanding what economic, social, and ideational factors affect these components and how changing mortality, fertility, and immigration may affect other family choices. With the growing emphasis on choice and on the consequences of population change, and with the shift from being a field focusing on forecasting to one focusing on understanding causal relationships, training across several fields of study has become necessary.

Admissions Information

The Certificate Program is offered to students enrolled in a Ph.D. program at the University of Maryland College Park.

Application Deadlines

Application Requirements

The Certificate Program is offered to students enrolled in a Ph.D. program at the University of Maryland College Park.

Degree Requirements

Population Studies (Cert)

Graduate Certificate (Cert)

Certificate in Population Studies (CPS)
The Certificate requires a minimum of four courses (12 credits) including two required core courses (chosen from three) and two electives (selected from a list of possibilities). At least one course taken for the Certificate must be from a department other than the student's home unit. (See the Certificate information page on the MPRC website for details.) Students must achieve a GPA of 3.0 or higher in these four courses. Previously earned credits may be retroactively applied toward the Certificate. Students may apply to participate in the Certificate Program at any time up until the semester before they intend to graduate. Applications may be accessed by following the link above.

Facilities and Special Resources

The Maryland Population Research Center (MPRC) is a multidisciplinary center dedicated to the support and advancement of population research. We provide a research environment conducive to interdisciplinary collaboration among our diverse Faculty Associates and to the development of young scholars through cross-disciplinary

training and mentoring. Our proximity to Washington DC allows us to develop strong relationships with the U.S. federal statistical agencies and with policy communities. These ties provide our researchers access to under-utilized or restricted-use government data, allow them to partner with agencies on research and data improvement projects, and allow them to provide policy makers with non-partisan, scientific evidence on population-related issues. MPRC provides workspace, a fully-equipped computer lab, a laptop loaner program, SAS and Stata training courses, and administrative and financial support to associated graduate students.

Financial Assistance

Contact Information

For more detailed information about the Graduate Certificate in Population Studies, please refer to the MPRC web site Certificate pages.

Dr. Joan Kahn, Professor, Department of Sociology
3137 Art-Sociology
College Park
MD 20742
Telephone: 301-405-6412
jkahn@umd.edu

http://www.popcenter.umd.edu/resources/mprc-associates/jkahn

Dr. Judith Hellerstein, Professor of Economics
3115J Tydings Hall
College Park
MD 20742
Telephone: 301-405-3545
hellerst@umd.edu

http://www.popcenter.umd.edu/resources/mprc-associates/hellerst

Courses:

Graduate Certificate: Survey Statistics (Z010)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Graduate Certificate: Urban Design (Z012)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Hearing and Speech Sciences (HESP)

Faculty:

Instructor
Department of Hearing and Speech Sciences

Abstract

The Department of Hearing and Speech Sciences provides the opportunity for advanced graduate study in the communication sciences and disorders. The department offers three degrees; this entry is for the Ph.D. program, with a concentrations in Hearing, Speech or Language. Students applying to the Ph.D. program can opt to receive an MA in Speech-Language Pathology en route to the final degree.

Students interested in the clinical MA degree in Speech-Language Pathology should see SPLA and use this code when applying for admission to study; students interested in a clinical doctorate in Audiology should see CAUD and use this code when applying for admission to study. At the doctoral level, the Ph.D. is offered in Hearing and Speech Sciences, with concentrations in Hearing, Speech or Language.

Admissions Information

Admission to the doctoral programs is on a very competitive basis. Our program is a mentoring-based program; we only accept doctoral students for whom there is an obvious mentor who is willing to work with that student. Students typically have high GPA and GRE scores, excellent letters of recommendation and statements of purpose, and a high-quality writing sample. Admission is currently confined to fall matriculation; early application is encouraged.

Admission to the Ph.D. degree program may be offered to applicants with either a Bachelor's or Master's degree. Clinical certification is not required for the degree, although a clinical graduate degree may be needed in addition to the Ph.D. degree for employment in some university settings. Students who wish to receive both degrees can apply to the Ph.D. program and receive a clinical MA while working towards the doctoral degree. Requirements for completion of a program of doctoral study are dependent on a student's prior background in the communication sciences and disorders.

Students who wish to focus primarily on research in communication sciences may apply either to the department directly, or may apply to the Program in Neuroscience and Cognitive Science (NACS) and select HESP as the home department. Students who apply to HESP directly may work towards receiving a certificate in NACS in addition to the HESP Ph.D.

Application Deadlines

Fall:
Applications must be received by January 15 .

Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Unofficial Transcript - (scan/upload) copies of transcripts (official transcript is required after acceptance into the program)
4. statement of purpose
5. for the Ph.D. program only, an additional writing sample is required

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Department also offers the Doctor of Philosophy degree with a major emphasis in speech, language or hearing. Students with a B.A. or M.A. are considered for admission to the doctoral program. Matriculated doctoral students will choose within their major a special interest area, which may focus on the normal aspects of their major or disorders related to the major. A student must also select a minor area of study either from within or outside departmental offerings. There are no foreign language requirements, but advanced courses in statistics and experimental research design are required for the degree. Course programs are planned by the student and a committee of at least four faculty members. All doctoral students are expected to participate in varied research activities within the Department for academic credit. Students must take written and oral comprehensive examinations for admission to candidacy after completing formal academic course work. Doctoral students must register for at least 12 semester hours of dissertation research credit before completing the degree. A full description of the Doctoral program, as well as listings of faculty research expertise, can be found at the Departmental web site, listed below.

Master of Arts (M.A.)

The Department of Hearing and Speech Sciences offers the Master of Arts degree with major emphasis in Speech-Language Pathology with either the thesis or the non-thesis option.The Master's degree is required by national credentialing standards for individuals intending to practice as speech pathologists in schools, hospitals, rehabilitation facilities, hearing and speech centers or in other clinical settings. Academic course work, which includes a minimum of 36 credits, is supplemented by additional credit registrations in supervised clinical practica in the University Speech and Hearing Clinic and in selected outside clinical facilities so that the graduate will meet the academic and practicum requirements for the Certificate of Clinical Competence (C.C.C.) issued by the American Speech-Language-Hearing Association, and be eligible for licensure in the State of Maryland and other jurisdictions. The Master's degree program is accredited by the Council on Academic Accreditation, the national accrediting agency which oversees graduate programs in Speech-Language Pathology and Audiology. A full description of the Master's degree program is available at our web site, listed below.

Doctor of Audiology (Au.D.)
The Department of Hearing and Speech Sciences offers two doctoral degree options for individuals seeking a clinical doctorate in Audiology. See CAUD for more details. The Au.D. curriculum meets requirements specified in the Standards for the Certificate of Clinical Competence in Audiology (CCC-A) of the American-Speech-Language-Hearing Association. The CCC-A is the minimum qualification for practice in Audiology required by most states and jurisdictions. The Au.D. program for post-BA students requires 57 hours of graduate coursework, 4 credit hours for a capstone research project, 14 hours of clinical practicum registration and 18 credit hours of full-time clinical internship registration, for a total of 93 credit hours. Au.D. students must pass comprehensive examinations and complete a capstone research project. Full-time students are expected to complete the program in 4 years. The Au.D. "fast-track" program for returning students who already hold an M.A. degree in Audiology and Clinical Certification requires 30 credit

hours of graduate coursework and 6 credit hours for a doctoral research project. There is no minimum requirement of supervised clinical practicum experience, although clinical practicum will be available to students as needed. The dual degree Au.D./Ph.D. track in Audiology is designed for students wishing to be trained as scientist-practitioners. The dual degree program requires 60 credits of graduate coursework, 6 credit hours of pre-candidacy research, 12 credit hours of dissertation research, 12 credit hours of clinical practicum registration, and 18 credit hours of full-time clinical internship registration, for a total of 108 credit hours. The Au.D./Ph.D. curriculum is designed to meet requirements specified in the Standards for the Certificate of Clinical Competence in Audiology (CCC-A) of the American Speech-Language-Hearing Association, and by the Graduate School. Ph.D. students must develop an individual study plan with the approval of a faculty Program Planning Committee, pass comprehensive examinations, and complete a dissertation and oral defense. Full-time students are expected to complete the dual-degree program in approximately 6-7 years.

Facilities and Special Resources

The Department's facilities include (1) numerous modern research laboratories equipped to support research in the areas of: acoustic phonetics, psychoacoustics, infant and adult speech perception, neuropsychology, language and language development, voice, fluency and electrophysiology. There are five sound-attenuating chambers and one electrically-shielded chamber devoted to research with humans, which are all integrated with computers and peripheral equipment for acoustic signal development, signal analysis, presentation and on-line data collection; (2) a Departmental library; (3) the Hearing and Speech Clinic at UMCP: this clinic serves as the initial practicum site for all students pursuing clinical training. The Clinic includes multiple audiological test suites equipped for diagnostic testing, a complete hearing aid dispensary, a group rehabilitation room, and state-of-the-art equipment for behavioral and electrophysiological diagnostic testing, as well as hearing aid selection and fitting. Ten speech and language diagnostic and therapy rooms are integrated with observation areas; and (4) an on-site language pre-school (LEAP, the Language-Learning Early Advantage Program), also equipped for observation. Students pursuing clinical training in Audiology will also have access to the Audiology Service, Division of Audiology-Head and Neck Surgery, of the University of Maryland and University Hospital in Baltimore (UMB), for part-time clinical rotations or full-time clinical externships. This Service provides a full range of auditory and vestibular diagnostic and rehabilitative services in a large metropolitan hospital setting. Externally-funded research projects are an integral part of the activities at UMB. All of the clinical and research facilities are potentially available for the conduct of student-directed research projects, or for student participation in faculty-initiated research projects. Additional research and clinical facilities are available in the Washington and Baltimore metropolitan areas. The Library of Congress, the National Library of Medicine and the libraries of various medical schools in the Washington-Baltimore area supplement the University's extensive libraries at College Park.

The Department of Hearing and Speech Sciences participates in the Neuroscience and Cognitive Sciences graduate program (see NACS), the Comparative and Evolutionary Biology of Hearing Training Grant, and the Maryland Language Science Center, and has ties to the Center for Advanced Study of Language (CASL); these connections afford students the opportunity to work with faculty in other departments at the University of Maryland, College Park, or at UMB.

Financial Assistance

A limited number of graduate assistantships and fellowships are available through the Department. Assistantships that carry teaching, research or clinical responsibilities are awarded on a competitive basis. The Department also recommends outstanding students for Graduate School Fellowships; many of these fellowships have early deadlines for recommendations, so students are encouraged to submit their applications to the department early to ensure full consideration for funding. Students may also seek assistantships elsewhere on campus (such as through the Dean's office or through other

departments) or doctoral fellowships sponsored by Federal agencies (e.g., NIH or NSF) or private foundations (e.g., American Speech-Language-Hearing Foundation).

Contact Information

Additional information about the M.A. and Ph.D. programs may be obtained by contacting Dr. Sandra Gordon-Salant, Ph.D., Graduate Director, or by e-mailing the program at hespadmissions@umd.edu; extensive information about the Department's programs, its faculty, research and facilities may be found at our web site: http://www.hesp.umd.edu.

Director of Graduate Studies: Sandra Gordon-Salant, Ph.D., CCC-A
Department of Hearing and Speech Sciences
0100 LeFrak Hall, College Park
MD 20742
Telephone: 301-405-4214
Fax: 301-314-2023
hespadmissions@umd.edu

http://www.hesp.umd.edu

Courses: HESP

Related Programs and Campus Units

Neuroscience and Cognitive Science
Clinical Audiology
Education: Human Development
Linguistics
Speech-Language Pathology

Higher Education, Student Affairs and International Education Policy (HESI)

Abstract

The Higher Education, Student Affairs, and International Education (HESI) program is committed to advancing the positive role education can have in society. Our faculty and students study core facets of the education system; this includes the functioning and impact of colleges and universities, student learning and development in higher education, and the enactment and implementation of K-18 and nonformal education policies in an international context. HESI offerings are characterized by a particular emphasis on social justice, diversity, policy, and system change. Our students and faculty are scholars, practitioners, change agents, and innovative leaders active in universities, as well as in national and international organizations and policy-making bodies. The program is a collaborative community that develops theory, conducts research and translates these to practice, and engages students, educators, and professionals in the advancement of education.

The HESI programs offers three areas of concentration: Higher Education; Student Affairs; and International Education Policy. Please only include one area of concentration on the application. Before applying students should familiarize themselves with each concentration area and choose the one that most closely fits their own particular needs and aspirations. The College of Education website (http://www.education.umd.edu/) offers descriptions of all the concentrations, faculty profiles and contact information, and is an essential resource for all applicants.

Graduate Degrees Offered: M.A., M.Ed., Ph.D.

Faculty:

Professor
Cabrera, Alberto
Fries-Britt, Sharon LaVonne
Klees, Steven J.
Lin, Jing
O'Meara, Kerry Ann
Stromquist, Nelly

Associate Professor
Griffin, Kimberly
Titus, Marvin

Assistant Professor
Espino, Michelle
Park, Julie J

Professor of Practice
Richardson, Patricia

Adjunct Professor
Waters, Robert

University Affiliate
Cohen, Helene Kalson

Professor Emerita
Komives, Susan R.
McEwen, Marylu K.

Note that, as of 2012, the HESI graduate programs are part of a new department, the Department of Counseling, Higher Education, and Special Education. Previously, Student Affairs was part of the Department of Counseling and Personnel Services and Higher Education and International Education Policy were part of the Department of Education Leadership, Higher Education and International Education.

Admissions Information

To be recommended for full admission to a doctoral or master's program, a minimum undergraduate grade point average of 3.0 is required. A minimum graduate grade point average of 3.5 is required for doctoral programs. Of the three scores on the Graduate Record Examination (verbal, quantitative, analytic), at least one should be at the 70th percentile or higher for PhD applicants (40th percentile or higher for master's applicants) and none should be under the 40th percentile for PhD applicants. If the Miller Analogies Test is used, the score should be at least at the 70th percentile for PhD applicants (40th percentile for master's applicants). Students who do not meet one of these requirements, but show other evidence of outstanding potential, may be considered for provisional admission. For more information on admissions please refer to our website at http://www.education.umd.edu/chse and click on prospective students.

No SPRING deadlines

Application Deadlines

Fall:
Fall Deadlines: Higher Education December 15 ; Organizational Leadership and Policy Studies (OLPS) and International Education Policy Studies (IEP) February 15. All materials including supplemental materials must be received by the deadline .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. Official transcripts from each college or university previously attended

2. Three Letters of Recommendation

3. Statement of Goals, Research Interests and Experiences

4. Scholarly writing sample for doctoral and master's applicants to the Higher Education and International Education Policy areas

5. Resume/vita

6. GRE or Miller Analogy Test

7. It is recommended that, if possible, prospective students talk with concentration coordinators and faculty, and visit classes, to help determine if a particular concentration is appropriate to their academic interests and professional goals. For detailed information about our programs please visit our website at http://www.education.umd.edu/chse.

Degree Requirements

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Doctor of Philosophy (Ph.D)
* Ph.D. students in Higher Education and International Education Policy are required to

take a minimum of 90 credits beyond the bachelor's degree, some of which may be satisfied by prior study.

* Ph.D. students in Student Affairs are required to take 66 credits beyond the Master's degree.

* In addition to major and elective courses, each concentration requires 15 to 18 credits in research methods and 12 credits of dissertation research.

* After students have completed most of their course work, a take-home comprehensive examination is required.

Master of Arts or Master of Education (M.A. or MEd)
* For Higher Education, the minimum number of credit hours beyond the bachelor's degree required of MA degree students is 36 credit hours.

* For International Education Policy, the minimum number of credit hours beyond the bachelor's degree for the MA degree is 30.

* For Student Affairs, which offers the MA and MEd, 40 credits beyond the bachelor's degree are required.

* Field experience is required for all concentrations except International Education Policy.

* In Student Affairs, MA students must do a thesis. MEd students complete a seminar paper.

* MA students in Higher Education and International Education Policy may do a thesis. If they choose the non-thesis option they must submit a seminar paper.

* All MEd students must do a seminar paper and a comprehensive examination.

Facilities and Special Resources

Faculty and students in the Department work closely with area schools, colleges, universities, associations and other education-related organizations. Extensive resources in the Washington, D.C., area, including international agencies and non-governmental organizations, provide exceptional opportunities for internships, field experiences, and research to enhance formal course experiences.

Financial Assistance

The Department has a very limited number of merit-based fellowships and graduate assistantships available to students. Fellowships are awarded to doctoral students in March only for the following fall semester. Assistantships are also awarded in the spring for the following fall semester, but occasionally an assistantship may become available at another time of year. A large number of assistantships are also available throughout campus, and many students regularly find assistantships in other departments and offices on campus. Both fellowships and assistantships are awarded on a competitive basis. It is to the student's advantage to apply well before the published application deadlines and to submit a complete application package if they intend to be considered for a fellowship, assistantship, or other form of financial aid. It is a requirement that a student be admitted as a condition of eligibility. International students' applications are not considered complete and are not reviewed by the Department until they have received clearance from the Office of International Student and Scholar Services (ISSS), which can take additional time. If you need information about ISSS clearance visit the

ISSS website athttp://www.umd.edu/ies. For more information on financial assistance, see the department web site: http://www.education.umd.edu/chse/admissions/finance.

Contact Information

For Additional information and application procedures, please visit our web site: http://www.education.umd.edu/chse/

Carol Ordiales Scott, Graduate Coordinator
Counseling, Higher Education, and Special Education University of Maryland 3214 Benjamin Building
3214 Benjamin Bldg College Park
MD 20742
Telephone: 301-405-8384
Fax: 301-405-9995
chse-admissions@umd.edu

http://www.education.umd.edu/chse

Graduate Assistant for Student Affairs - Shelvia English
3214 Benjamin Bldg
College Park
MD 20740
sagrad-ga@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/StudentAffairs1.html

Graduate Assistant for Higher Education - Nina Daoud
3214 Benjamin Bldg
College Park
MD 20740
ndaoud@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/HE.html

Graduate Assistant for International Education Policy - Changha Lee
3214 Benjamin Bldg College Park
MD 20740
changha@umd.edu

http://www.education.umd.edu/CHSE/academics/specialization/IE.html

Courses: EDPL

Related Programs and Campus Units

Education: Counseling Psychology, School Psychology, and Counselor Education

Historic Preservation (HISP)

Faculty:

Acting Associate Dean
Donald Linebaugh

Chair
Donald Linebaugh

Professor
Donald Linebaugh

Abstract

Based in the School of Architecture, Planning, and Preservation, the Historic Preservation Program is a collaboration of faculty from across the University--from the departments of American Studies, Anthropology, Architecture, History, Landscape Architecture, Real Estate Development, and Urban Studies and Planning, as well as the National Trust Library. Our shared goal is educating professionals for work in a wide range of preservation organizations. Research on historic preservation issues is also a

focus of the Program, pursued through faculty and student projects, in partnership with preservation organizations, agencies and University partners.

The Historic Preservation Program offers a Master of Historic Preservation (MHP) degree, a graduate Certificate, and several dual degrees (with Architecture, Planning, and Real Estate Development). The MHP is designed as a full-time, two-year curriculum leading to a professional degree. The 45-credit MHP curriculum includes core courses, an internship, an interdisciplinary studio course, a final project, and a large selection of electives to stimulate each student's particular interests. Students will be admitted to the program with a variety of backgrounds but with a demonstrated prior interest in the preservation field. (In some exceptional cases, students may be admitted to the program on a part-time basis.)

Assistant Professor
Michele Lamprakos

Research Associate
John Sprinkle, Jr.
Kirsten Crase

University Affiliate
Brent Leggs
Constance Werner Ramirez
Dennis J. Pogue
Doug McElrath
Fred Stachura
Mary Corbin-Sies
Paul Shackel
Rick Bell

Admissions Information

The application process consists of the following:

First, fill out the on-line application for the University of Maryland Graduate School. The administrative code for the Historic Preservation program is "HISP."

Second, submit all transcripts, three professional letters of recommendation, statement of purpose, resume, official GRE test scores, and portfolio as part of the application.

All applicants must have a bachelor's degree from an accredited institution. There is no restriction on the applicants' previous field of study, and indeed we encourage diversity in all senses.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. Complete Application Form (http://www.gradschool.umd.edu/admissions/application-process/step-step-guide-applying)
2. Transcripts
3. Standardized test scores: Applicants with undergraduate degree awarded less than 5 years from the date of application, must submit a Graduate Record Examination (GRE)
4. Letters of Recommendation: Three confidential letters submitted by professors or others who can assess the quality of the applicant's potential to succeed in the graduate program.
5. Statement of Goals, Experiences, and Research Interests: 1000-2000 word statement of goals and objectives in pursuing graduate study in architecture at the University of Maryland.
6. Resume
7. Writing sample (this can be previous academic work or professional work; it does not necessarily have to be related to historic preservation; it must be individual work). In addition, applicants may submit samples of graphic work. Please submit copies, as this material is not returnable.

Degree Requirements

Dual Degree Program in Historic Preservation and Real Estate Development (HPDV)

This is a dual degree program in Historic Preservation and Real Estate Development with course requirements overlapping such that a student can qualify for both degrees with some careful planning and an extra semester of coursework. It is recommended that applicants consult with the program directors of both HISP and RDEV before proceeding with the application. Differential tuition rates are likely to be instituted at some point after

which all courses taken will be subject to the adjusted rate. The dual degree does allow for students to obtain both degrees with fewer credits than would be required taking the two degrees independently.

Master of Community Planning and Historic Preservation (CPHP)
The dual degree combines course work from the Community Planning and Historic Preservation programs to enable a student to complete both the Master of Community Planning and the Master of Historic Presevation with fewer credits than it would take to complete the two separately. Applicants for the dual degree in Community Planning and Historic Preservation should use the CPHP program code.

Dual Degree Program in Architecture and Historic Preservation (ARHP)
The dual degree combines course work from the Architecture and Historic Preservation programs to enable a student to complete both the Master of Architecture and Master of Historic Preservation degrees with fewer credits than it would take to complete the two separately.

Master of Historic Preservation (M.H.P.)
The Master of Historic Preservation (MHP) requires completion of 45 credits. Required courses cover history and theory of preservation, preservation law, historical research methods,documentation, conservation, preservation economics, preservation planning & policy, group studio/workshop, internship, and independent final project. Elective courses may be taken from all contributing HISP units, and other departments with prior approval from the HISP Director. A description of the full MHP curriculum is available on the program web site at http://arch.umd.edu/hisp/historic-preservation.

Facilities and Special Resources

The University of Maryland's Historic Preservation Program is privileged to be part of a dynamic, successful preservation community that has long thrived throughout the state and in the District of Columbia. Opportunities to study and work abound in the incredibly diverse cities, towns, and landscapes across Maryland. In addition, the Program enjoys close relationships with many state, local, national, international and federal-government organizations working in historic preservation, as well as non-profit groups and private firms.

The HISP program is directly related to and substantially enhanced by the National Trust for Historic Preservation Library, housed on the College Park campus since 1986 [http://www.lib.umd.edu/NTL/ntl.html]. This Library is one of the leading scholarly resources for preservation in the country. The program is further strengthened by close working relationships with the Maryland Historical Trust, the National Park Service, the National Trust for Historic Preservation, the Maryland National Capital Park and Planning Commission, Historic Annapolis, Inc., Preservation Maryland, Prince George's Heritage, the Anacostia Trails Heritage Area, and others. Practical experience can be gained through a variety of internship opportunities with these organizations and many others.

Financial Assistance

HISP's principal form of financial aid consists of graduate assistantships related to research and outreach activities. The assistantships consist of tuition remission as well as a stipend. In addition, the Program awards--in conjunction with local non-profit Prince George's Heritage--the Prince George's Heritage Preservation Fellowship, an annual competitive award for a HISP student or students whose Prince George's County related project is judged to be especially outstanding. Additionally, there are possibilities for paid internships and paid part-time work with a variety of national and local organizations and governmental agencies.

Contact Information

Contact the program at the following address:

HISP Graduate Admissions
School of Architecture, Planning and Preservation
University of Maryland
College Park, MD 20742

Or at the School of Architecture, Planning, and Preservation web site:http://arch.umd.edu/mapp/graduate-inquiry-form

Dr. Donald Linebaugh, Ph.D., Director
School of Architecture, Planning, and Preservation
University of Maryland
College Park
MD 20742
Telephone: (301) 405-6309
Fax: (301) 314-9583
dwline@umd.edu

http://www.arch.umd.edu/preservation/

Courses: RDEV HISP ARCH URSP

Related Programs and Campus Units

Architecture
Urban and Regional Planning and Design
Anthropology
Real Estate Development
Landscape Architecture
Architecture and Real Estate Development

Historic Preservation Certificate (HISP)

Faculty:

Abstract

The Historic Preservation Graduate Certificate program augments the degree work of Master of Architecture, Master of Arts and Doctor of Philosophy students in the seven cooperating academic units: American Studies, Anthropology, Architecture, Geography, History, Horticulture and Landscape Architecture, and Urban Studies and Planning.

Admissions Information

This 24-credit interdisciplinary program is designed to help prepare students for a range of careers in the planning, management and conservation of significant cultural, natural and historical resources. Through courses, seminars and internships, students develop the basic expertise to become researchers, interpreters, curators, restorationists, archaeologists, planners, conservators and administrators in the multi-faceted field of historic preservation.

Students who seek the Certificate must meet general Graduate School requirements and normally they must have been admitted into one of the participating degree programs. Application is in the form of a letter to the Committee on Historic Preservation. In making its evaluation, the Committee will review relevant material in the Graduate School application. If appropriate, the applicant's record as a graduate student or resume generated through professional experience will be considered. Interested persons are advised to consult in advance with the chair of the Committee.

Application Deadlines

Fall:
Applications must be received by .
Spring:
Applications must be received by .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Degree Requirements

Historic Preservation Graduate Certificate (Certificate)
Certificate students, in conjunction with their degree programs, complete the required introductory seminar (HISP 600), a survey of preservation law, 15 credit hours of core courses, and the final seminar (HISP 700). The total number of semester credit hours will vary according to the particular requirements of the specific degree program.

Facilities and Special Resources

The Certificate program is directly related to and substantially enhanced by the National Trust for Historic Preservation Library housed on the College Park campus since 1986. The program is further strengthened by close working relationships with the National Park Service, the Maryland Historical Trust, the Maryland Hall of Records, the Maryland National Capital Park and Planning Commission, Historic Annapolis, Inc., Preservation Maryland, the Baltimore Commission for Historical and Architectural Preservation, the Maryland Heritage Alliance, the Maryland Historical Society, and the Montgomery and Prince George's County Historic Preservation Commissions. Practical experience can be gained through ongoing summer projects at the Chalfonte Hotel in Cape May, New Jersey and at Kiplin hall in North Yorkshire, England.

Financial Assistance

HISP's principal form of financial aid is the Prince George's Heritage Preservation Fellowship, an annual competitive award which provides a matching tuition waiver and stipend for a Certificate student whose Prince George's County related project is judged by the faculty and the sponsor to be especially outstanding and promising. Additionally, there are possibilities of paid internships with the National Park Service and the Historic American Building Survey/Historic American Engineering Record. Certificate students may be teaching assistants in related academic units. Also, students in the Certificate Program are specially eligible for the annual Prince George's County specific Margaret Cook Award, a cash prize endowed by the Historical and Cultural Trust of Prince George's County. The St. Clair Wright Historic Preservation Award is a cash award given to a HISP student who demonstrates the principles of preservation activism exemplified by Mrs. Wright, founder and leader of Historic Annapolis. The Historic Preservation Faculty Prize is given to a student in a historic preservation course who has submitted a paper or project of outstanding quality on a topic in historic preservation.

Contact Information

Prof. Randall Mason, Director
1298 School of Architecture College Park, MD 20742
MD 20742
Telephone: (301) 405-6309
Fax: (301) 314-9583
hisp-grad@deans.umd.edu

http://www.arch.umd.edu

Courses: HISP

Historic Preservation and Real Estate Development (HPDV)

Faculty:

Dual degree programs, such as Historic Preservation and Real Estate Development, can have complicated requirements and applications. It is recommended that you consult with the Program Directors of each program before proceeding to apply. See contact information below.

Application deadline for the program is December 15 for International Applicants and January 1 for Domestic Applicants. If you miss the deadline, you may apply and be considered for the real estate development program up until August 1st, but would have to apply for the Historic Preservation part of the dual degree program in the year following.

The School has requested a differential tuition for in-state students in order to defray the higher cost of offering the dual degree program. The tuition differential, if approved, will be announced to all enrolled students, and will only be applied going forward for the semester following the announcement.

Abstract

Based in the School of Architecture, Planning, and Preservation, the Historic Preservation Program is a collaboration of faculty from across the University--from the departments of American Studies, Anthropology, Architecture, History, Landscape Architecture, and Urban Studies and Planning, as well as the National Trust Library. Our shared goal is educating professionals for work in a wide range of preservation organizations. Research on historic preservation issues is also a focus of the Program, pursued through faculty and student projects, in partnership with preservation organizations and University partners.

The dual degree program in Historic Preservation and Real Estate Development is a 60 credit program that can be completed, by taking courses full time over 5 semesters (2 1/2 years), including at least one winter and summer term course. While not preferred students may be admitted to the program on a part-time basis. Consult with the HISP Program Director.

The final project for the HISP portion of the degree will also have to meet the requirements for a Capstone Project in real estate development and should be discussed early on with each Program Director to be sure it will meet the requirements of both.

Admissions Information

The application process consists of the following:

First, fill out the on-line application for the University of Maryland Graduate School. The administrative code for the dual degree of Master of Historic Preservation and Master of Real Estate Development is "HPDV."

Second, submit all transcripts, three professional letters of recommendation, statement of purpose, resume, official GRE test scores, and portfolio as part of the application.

All applicants must have a bachelor's degree from an accredited institution. There is no restriction on the applicants' previous field of study, and indeed we encourage diversity in all senses.

A writing sample of at least 10-30 pages is required. This can be previous individual academic or professional work. It does not necessarily have to be related to historic preservation or real estate development, however a related topic is preferred. The writing sample should demonstrate the ability to analyze a problem/question and clearly communicate your findings.

Application Deadlines

Application Requirements

1. Statement of Purpose - specific to interest in dual degree
2. Graduate Record Examination (GRE), Graduate Management Admission Test (GMAT, or Law School Admissions Test (LSAT)
3. Transcript(s)
4. Letters of Recommendation (3)
5. CV/Resume
6. Writing Sample
7. TOEFL/IELTS/PTE (international applicants only)

Degree Requirements

Historic Preservation and Real Estate Development (HPDV)
The dual degree for a Master of Historic Preservation (MHP) and a Master of Real Estate Development (MRED) requires completion of 60 credits. Required courses cover history and theory of preservation, preservation law, historical research methods, documentation, conservation, preservation economics, preservation planning & policy, group studio/workshop, and independent final project.

Real Estate requirements address real estate economics, finance, planning and entitlements, design and construction management and asset and property management.

The final project must not only address historic preservation or adaptive reuse issues, but must meet the requirements of an MRED Capstone project with real estate feasibility and pro forma modelling.

Facilities and Special Resources

The School of Architecture, Planning, and Preservation and the Colvin Institute of Real Estate Development are ideally located between Washington, DC, and Baltimore and surrounded by a number of historic communities and a varied physical environment. The resulting opportunity for real estate development and historic preservation study is unsurpassed.

Close by the University are key historically important and interesting places in the development of U.S. communities, including the 4th settlement in America at Historic St. Mary's City in Southern Maryland, which was the first planned city in America. Just 10 minutes from campus is the 1930s new town of Greenbelt, Maryland, and within 45 minutes are the 1960's new towns of Columbia, Maryland, St. Charles, Maryland and Reston, Virginia. One of the best examples of new urbanism is the Kentlands development less than 30 minutes away. And not to be missed are the major redevelopment and urban living revivals in the Port City of Baltimore and the historic neighborhoods of Anacostia and Columbia Heights in the District of Columbia.

The University of Maryland's Historic Preservation Program is privileged to be part of a dynamic, successful preservation community that has long thrived throughout the state and in the District of Columbia. Opportunities to study and work abound in the incredibly diverse cities, towns, and landscapes across Maryland. In addition, the Program enjoys close relationships with many state, local, national, international and federal-government organizations working in historic preservation, as well as non-profit groups and private firms.

The HISP program is directly related to and substantially enhanced by the National Trust for Historic Preservation Library, housed on the College Park campus since 1986 [http://www.lib.umd.edu/NTL/ntl.html]. This Library is one of the leading scholarly resources for preservation in the country. The program is further strengthened by close working relationships with the Maryland Historical Trust, the National Park Service, the National Trust for Historic Preservation, the Maryland National Capital Park and Planning Commission, Historic Annapolis, Inc., Preservation Maryland, Prince George's Heritage, the Anacostia Trails Heritage Area, and others. Practical experience can be gained through a variety of internship opportunities with these organizations and many others.

The School's resources include a model shop, a digital fabrication lab, and both PC and MAC computer labs with REVIT, ARGUS, GIS, Maptitude and other design programs available. The School's library contains some 57,000 monographs and 6,000 current periodicals, making it one of the major architectural libraries in the nation. The National Trust Library for Historic Preservation, housed in McKeldin Library, contains 11,000 volumes and 450 periodical titles. THe Colvin Institute holds the entire library offerings of the Urban Land Institute and access to all the case studies published by ULI. The slide collection includes approximately 430,000 slides on architecture, landscape architecture, planning, and technical subjects. The interdisciplinary National Center for Smart Growth Education and Research is based in the School offering perspectives and opportunities to engage important issues facing urban and regional planning.

Both the Real Estate Development and Historic Preservation Programs benefit from the strong support of the professional community, including practitioners who bring expertise into the class room and project courses as instructors and advisors. The RDEV courses are all taught by working or retired real estate professionals giving unparalleled access for students to making connections with current practice in the industry.

Job placement for HISP graduates has been outstanding with graduates sought out by national, local and regional firms and agencies. The over 150 alumni of the real estate program have a very active and passionate group of grads in the area who meet regularly and share practice tips, connections and future job opportunities.

Financial Assistance

HISP's principal form of financial aid consists of graduate assistantships related to research and outreach activities. The assistantships consist of tuition remission as well as a stipend. In addition, the Program awards--in conjunction with local non-profit Prince George's Heritage--the Prince George's Heritage Preservation Fellowship, an annual competitive award for a HISP student or students whose Prince George's County related project is judged to be especially outstanding. Additionally, there are possibilities for paid internships and paid part-time work with a variety of national and local organizations and governmental agencies.

The Colvin Institute provides scholarship funds to a number of highly qualified students each term. Scholarship determinations are made at the time of application and admission. Scholarships are generally awarded on a per course basis and commitments are made at the time of admission and apply for the duration of the entire program, subject to academic performance.

The MRED Program offers a limited number of administrative graduate assistantships to full time MRED students. Contact the Program Director to apply. Periodically there are named scholarships provided by various real estate organizations or development companies.

In addition, there are work opportunities both on, and off campus, and they are relatively plentiful. Students in the past have been successful in finding part time internships and full time work with local real estate companies. The MRED student listserv posts openings periodically as they are brought to the attention of the Program by alumni, friends, faculty and sponsors.

Applicants should inquire as to the availability of scholarship funding for the term they are starting. Scholarships are typically for a portion of tuition only, and are paid on a per course basis as students progress through the program. Scholarships are available to part time, full time, and dual degree students.

Contact Information

Contact the programs at the following address: HISP/RDEV Graduate Admissions School of Architecture, Planning, and Preservation Building 145, Faculty Suite University of Maryland College Park, MD 20742

Find additional information on program offerings, degree requirements, admissions, and financial aid on the School's Web site (www.arch.umd.edu).

Schedule a visit and tour online at: http://www.arch.umd.edu/students/advising/. Be sure to contact the Program Director for real estate development (mmcf@Umd.edu) if you wish to attend a sampling of classes while here.

Sign up to receive an invitation to our Graduate Open Houses in Fall or Spring online at: http://www.arch.umd.edu/students/admissions/information_request.cfm

For further information about the Preservation Program, please contact Don Linebaugh, grarchadvise@umd.edu, 301-405-8000.

For further information about the Real Estate Development Program and the Colvin Institute, please contact Margaret McFarland, JD, Director of Graduate programs in Real Estate Development and the Colvin Institute of Real Estate Development, mmcf@Umd.edu.

Additional information on Case competitions, samples of student work, as well as syllabi and adjunct faculty can be found at the School's web site (www.arch.umd.edu. You will also find the Colvin Institute offering outreach and information at the ICSC in Las Vegas each May, at the ULI National Conference each October, and at many local events of Bisnow, ICSC, ULI, CREW, WIRRE and HAND.

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Telephone: 301-405-8000
dwline@umd.edu

http://www.arch.umd.edu/preservation/

Margaret McFarland, JD, Director, Graduate Programs in Real Estate Development and The Colvin Institute of Real Estate Development
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College Park
MD 20742
Telephone: 301-405-8000
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http://arch.umd.edu/rdev/real-estate-development

Courses:

Related Programs and Campus Units

American Studies

History (HIST)

Abstract

The Department of History offers programs leading to the degrees of Master of Arts and Doctor of Philosophy. In conjunction with the College of Information Studies, the Department of History also offers a dual-degree Master of Arts in History and Library Science.

Major fields of concentration for the MA and PhD programs are: Ancient Mediterranean, Medieval, Early Modern Europe, Modern Europe, Global Interaction and Exchange, International, Jewish, Latin America, Middle East, Russia & Eurasia, Technology, Science, & Environment, the United States, and Women & Gender. MA-only fields are: Africa and Military.

The graduate program, which includes over fifty regular faculty members and approximately 100 degree-seeking students, excels in the following subfields: African-American, US, and Middle East. Other areas of established strength are Western and Central Europe, Russia and Eurasia, Ancient Mediterranean, Latin America, and Women & Gender. More recently, the following fields have emerged as centers of growing faculty strength and are attracting increasing numbers of students and faculty: Atlantic history, the African diaspora, and Global Interaction and Exchange.

The students in our three degree programs come from across the nation, from small liberal arts colleges and major research institutions, as well as from Europe, Canada, the Middle East, Russia, and Latin America. History students have won a number of major external fellowships, including the ACLS/Mellon Early Career Fellowship, the Fulbright-Hays Doctoral Research Fellowship, the Berlin Program for Advanced German and European Studies Dissertation Fellowship, the Foundation for the Research and Study of the East German Dictatorship Fellowship, the Fulbright-IIE Student Grant, the International Research & Exchanges Board Fellowship, the Mary Savage Snouffer Dissertation Fellowship, the Library Company of Philadelphia Fellowship, the Maryland Historical Society Lord Baltimore Research Fellowship, the Massachusetts Historical Society Research Fellowship, the Center for Jewish History Fellowship, and the Mellon Fellowship for Dissertation Research in Original Sources.

Recent graduates have started postdoctoral fellowships or tenure-track jobs at institutions that include Case Western University, George Washington University, Bucknell University, Claremont-McKenna College,Christopher Newport University, Morgan State University, Johns Hopkins University, Rice University, Pennsylvania State University, Iowa State University, Montclair State University, Ohio University, Rhode Island College, SUNY Purchase, the United States Naval Academy, the University of South Florida, Framingham State University, the University of Southern Mississippi, and Western Washington University. The members of our extended alumni community, numbering more than 300 master of arts and doctoral recipients, work as professional historians throughout the State of Maryland, in a number of United States Government agencies, and at institutions of higher education and historical research across the United States and the globe.

Admissions Information

As a demonstration of our commitment to excellence in historical scholarship and education, admission to our degree programs is highly competitive. It is important that each applicant clearly articulate his/her academic preparation and qualifications for graduate study at Maryland. All prospective applicants are encouraged to make contact with the faculty in the area(s) of interest. Faculty play an important role in the admissions decision. Prospective applicants are also encouraged to make contact with current graduate students to learn more about their experiences. The History Graduate Student Association can facilitate communications with current students.

Faculty:

Chair
Soergel, Philip

Distinguished University Professor
Berlin, Ira
Herf, Jeffrey

Professor
Eckstein, Arthur M.
Friedel, Robert D.
Greene, Julie
Karamustafa, Ahmet
Landau, Paul
Lapin, Hayim
Muncy, Robyn L.
Price, Richard N.
Ross, Michael
Rozenblit, Marsha L.
Soergel, Philip
Sumida, Jon T.
Sutherland, Donald M. G.
Zilfi, Madeline C.

Associate Professor
Barkley Brown, Elsa
Bell, Richard J.
Bianchini, Janna
Borrut, Antoine
Brewer, Holly
Caneque, Alejandro
Cooperman, Bernard Dov
Dolbilov, Mikhail
Freund, David
Gao, James Z.
Giovacchini, Saverio
Lyons, Clare A.
Ridgway, Whitman H.
Rosemblatt, Karin A.
Rowland, Leslie S.
Sartorius, David
Sicilia, David B.
Villani, Stefano
Wien, Peter
Williams, Daryle
Zeller, Thomas G.

Assistant Professor
Bonner, Christopher
Bradbury, Miles L.
Cameron, Sarah
Kosicki, Piotr
Rodriguez, Chantel
Woods, Colleen
Zhang, Ting

Affiliate Professor
Gerstle, Gary
Moses, Claire G.

Visiting Assistant Professor
Taddeo, Julie Anne

Distinguished University Professor Emeritus
Brush, Stephen G.
Gilbert, James B.

Applicants are required to submit a sample of written work of historical scholarship, such as a research paper or thesis, as well as a statement of purpose, transcripts, three letters of recommendation, and GRE scores. Additional materials may be requested.

Although there are exceptions, the minimum overall grade point average is 3.25 for admission to a master's degree program and 3.50 for admission to the doctoral program. The admissions committee would typically expect a higher grade point average in past coursework in history and related disciplines. Successful applicants usually score above the 80th percentile in the analytical writing and verbal reasoning portions of the Graduate Record Examination (GRE) General Test. The Department does not require a GRE Subject Test.

There is no language requirement for the MA degree, but the command of one or more languages is required for admission into the PhD program in some fields within History. For more information on language requirements, see the History Department website.

The admissions process is sensitive to variations in GRE scores among applicants whose primary language is not English. However, the University requires that all admitted students demonstrate proficiency in written and spoken English.

Professor Emerita
Gullickson, Gay L.
Michel, Sonya A.
Olson, Alison G.
Vaughan, Mary Kay

Professor Emeritus
Belz, Herman J.
Callcott, George H.
Foust, Clifford M.
Harris, James F.
Henretta, James A.
Holum, Kenneth G.
Lampe, John R.
Olson, Keith W.

Associate Professor Emerita
Mayo, Marlene J.

Associate Professor Emeritus
Breslow, Marvin A.
Grimsted, David A.
Majeska, George P.
Moss, Alfred A., Jr.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Statements of Goals & Research Interests and Experiences
2. Three (3) Letters of Recommendation
3. A Writing Sample that demonstrates historical analysis, such as a research paper or master's thesis
4. Resume or Curriculum Vitae
5. Transcripts
6. GRE General

Degree Requirements

Master of Arts (M.A.)

Organized in the 1920s, the Master of Arts in History program at the University of Maryland provides broad and intensive instruction in bibliography, research, and writing in various fields of historical study. The MA degree may constitute a step toward doctoral research or preparation for a variety of other fields, such as archives administration, museum scholarship and exhibitions, public history, primary or secondary school teaching, law, or international relations.

Admission to the Master of Arts program is offered to highly qualified applicants holding at least a bachelor's degree, normally in history or a related discipline. Application and admissions procedures are described on the Department's website.

The MA degree program requires a total of thirty (30) semester hours of course work and research credits and the submission of one or two original research papers. In addition, MA students must successfully defend a thesis (the Degree-by-Thesis option) or pass a written examination (the Degree-by-Examination or "non-thesis" option).

The anticipated period for completion is two (2) years of full-time study. The degree must be completed within five (5) years.

Doctor of Philosophy (Ph.D.)

First awarded in 1937, the Doctorate in History at the University of Maryland is conferred for superior achievement in historical study and research. The major portion of the degree is the dissertation, an original and noteworthy contribution to historical knowledge. In anticipation of this research, students must master the historical literature in their fields, bibliographic tools, research and writing methods, and general, special, and minor fields of study. Competence in these preliminary steps will be measured by successful completion of course work and by written and oral comprehensive examinations.

Unless they have taken comparable courses elsewhere, students must complete the general seminar(s) in their major field, History 601 (History and Contemporary Theory), a minimum of nine hours of reading courses, six hours of research seminars, and nine hours in a minor field.

Depending on the field of study, doctoral students may be required to demonstrate competence in one or more foreign languages and/or special skills.

Students who enter with a master's degree in history or a related field are expected to sit for a set of written and oral comprehensive examinations within five semesters. Those who enter with a bachelor's degree typically take the comprehensive exams within six semesters. Upon successful completion of all examinations, doctoral students are expected to prepare a dissertation prospectus and advance to doctoral candidacy within one or two semesters. Upon completion of the dissertation research and writing, candidates defend the dissertation in an oral examination.

The requirements for the doctoral degree are intended to be completed in five to six years. For more information, see the History Department website.

Facilities and Special Resources

In addition to the field concentrations described above, the Department of History offers several forms of specialized training, including certificate programs in Museum Scholarship & Material Culture, co-sponsored by the Departments of American Studies and Antropology, and Historic Preservation, co-sponsored by the School of Architecture.

The Nathan and Jeanette Miller Center for Historical Studies, housed within the Department, promotes both research and graduate training by sponsoring seminars and colloquia, major scholarly conferences, and visiting professors who teach graduate courses. Typically, the Center's activities each year concentrate on an interesting historical theme that cuts across the usual chronological and cultural boundaries.

The University of Maryland is home to a number of important archives, special collections, and historical editing projects, including the archives of the American Federation of Labor-Congress of Industrial Organizations (AFL-CIO), the Freedmen and Southern Society Project and the Samuel Gompers Papers, the Library of American Broadcasting, the Gordon W. Prange Collection, and the National Trust for Historic Preservation Library. The Combined Caesarea Expeditions, an archeological project that joins excavation of the terrestrial remains of Caesarea Maritima with underwater investigation of the site's ancient harbor, are coordinated at Maryland.

The University sponsors a number of significant scholarly publications of interest to historians, including the *Hispanic American Historical Review*, the flagship English-

language journal in Latin American history; and *Feminist Studies*, a pioneer in women's history and gender studies.

The College Park campus is located within the Washington-Baltimore corridor, one of the nation's most dynamic regions for historical research. Francis Scott Key Hall, home to the Department of History, sits less than ten minutes from Archives II (National Archives and Records Administration), the U.S. government's largest repository, and less than thirty minutes from downtown Washington, D.C., a city of unparalleled cultural resources and unique opportunities for historical research, including the Library of Congress, the Folger Library, and the US Holocaust Memorial Museum. Annapolis and Baltimore, home to significant archival holdings related to the history and cultures of the State of Maryland, the greater Chesapeake Bay region, and the Atlantic world, can be reached in less than forty-five minutes.

Financial Assistance

The Department of History administers several forms of financial assistance for graduate students, including fellowships, teaching assistantships, graduate assistantships, research assistantships, and research grants. All fellowships, assistantships, and grants are awarded on the basis of merit, as determined by the Graduate Committee, upon the recommendation of faculty and the Director of Graduate Studies.

A multiyear guarantee of continuous funding is frequently offered to newly matriculating PhD students. Guaranteed funding is not standard for students entering the MA and HiLS programs.

Funding packages typically include one or two years of fellowship and three years of Teaching Assistantship. The packages include tuition remission and a health benefits option, subject to satisfactory progress towards the fulfillment of program requirements. Some funding packages are just for five years of continuous Teaching Assistantships. All teaching assistants receive tuition remission and a health benefits option.

For FY2016 (2015-16 academic year), the pay scale for 9.5-month teaching, graduate, and research assistantships range between $18,028 and $18,755. Fellowships follow a similar pay scale. Assistantships and fellowships include tuition remission and a health benefits option. Variations in stipend amounts are due to a number of factors, including the type of appointment, international student status, previous appointments, and advancement to candidacy.

Additional funding is available through the Arts and Humanities Research and Travel Grant competition, Department semester dissertation fellowships, the summer Prospectus Development Grant competition, matching funds for travel to academic conferences, and various campus-wide dissertation writing grants administered on a competitive basis by the Graduate School. All doctoral students are expected to seek outside funding for pre-dissertation and dissertation research, as appropriate.

History graduate students may seek grants and fellowships, assistantships, hourly employment, and other forms of self-support offered by non-departmental sources.

Contact Information

For complete description of programs and requirements, please see the History Department website (www.history.umd.edu) or contact:

Director of Graduate Studies
2115 Francis Scott Key Hall
Department of History
University of Maryland
College Park, MD 20742-7315 USA

TEL: (301) 405-4268
FAX: (301) 314-9399

see also:
Studies Leading to the Certificate in Historic Preservation
(See entry under Certificate Programs)

History/Library & Information Systems (HILS) dual degree program resulting in an M.A. in History and an M.L.S. in Library Science.

Dr. Marsha Rozenblit, Director of Graduate Studies;
Department of History 2115 Francis Scott Key Hall
College Park
MD 20742-7315
Telephone: (301) 405-4267
Fax: (301) 314-9399
mrozenbl@umd.edu

http://www.history.umd.edu/graduate

Program Coordinator, Jodi Hall
Department of History 2115 Francis Scott Key Hall
College Park
MD 20742
Telephone: 301-405-4268
Fax: 301-314-9399
jlhall@umd.edu

http://history.umd.edu/graduate

Courses: HIST

History/Library Science (HILS)

Abstract

The History and Library Science (HiLS) dual-degree program is the result of a cooperative agreement between the College of Information Studies, Maryland's iSchool, and the Department of History. HiLS students graduate with both a Master of Arts in History and a Master of Library Science (MLS) degree.

The HiLS program is ideally suited for students interested in historical scholarship and research and applied skills. Because of the proximity of the College Park campus to a variety of immensely rich research collections, students are able to gain first-hand experiences through internships that reinforce their classroom instruction. As a result of the dual-degree studies, students in the HiLS program gain skills in historical methodology and cutting-edge information science practices that prepare them for careers in libraries, archives, museums, and other information centers in the public, private, and non-profit sectors.

Students admitted to the HiLS Program typically complete the program of study in three (3) years, however they have up to five (5) years to complete the degrees. The HiLS program requires fifty-four (54) credit hours of study, with a minimum of twenty-four (24) hours in both the Department of History and the College of Information Studies. Students select how to use the remaining six (6) credits.

The MA and the MLS are awarded simultaneously, and a student who fails to complete the special requirements for the coordinated degree programs may not receive either degree. When a student admitted to the HILS program subsequently wishes to receive

Faculty:

Dean
Preece, Jennifer J.

Associate Dean
Weeks, Ann C.

Director
Diker, Vedat

Professor
Bertot, John
Butler, Brian
Druin, Allison J.
Marciano, Richard
Oard, Douglas William

Associate Professor
Golbeck, Jen
Jaeger, Paul T.
Kraus, Kari Michaele
Subramaniam, Mega M.
Wang, Ping

Assistant Professor
Chetty, Marshini
Findlater, Leah
Frias-Martinez, Vanessa
Shilton, Katie

only one degree, he/she must transfer from HILS either to the graduate program in History or to the College of Information Studies and fulfill the normal requirements for the separate master's degree. The dual-degree History and Library Science offers the option of a degree-by-thesis (History and iSchool) as well as a degree-by-examination (History).

Admissions Information

Students must apply for admission to both the Department of History and the College of Information Studies. There is one, consolidated application (select History and Library Science), but two, independent admission decisions. An offer of admission from both the Department of History and the College of Information Studies is required in order to be admitted to the dual-degree program.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Statement of Purpose
2. Writing Sample (History requirement)
3. 500 word targeted essay (iSchool requirement)
4. Three Letters of Recommendation
5. CV/Resume
6. Transcripts
7. GRE General

Degree Requirements

History and Library Science Joint Degree (M.A. M.L.S)

Facilities and Special Resources

The College of Information Studies operates five research centers: the Human-Computer Interaction Lab (HCIL), the Information Policy and Access Center (iPAC), and the Center for Advanced Study of Communities and Information (CASCI), the Cloud Computing Center (CCC), and the Digital Curation Innovation Center (DCIC). iSchool faculty and doctoral students also participate in or have affiliations with the University of Maryland Institute for Advanced Computer Studies (UMIACS), the Maryland Institute for Technology in the Humanities (MITH), and the Computational Linguistics and Information Processing Laboratory (CLIP), as well as the Departments of Computer Science, English, and Sociology, the Robert H. Smith School of Business, and the College of Education.

The College also operates a student computer lab for currently enrolled students.

Faculty and students participate in cooperative research with staff of the University Libraries, the Human-Computer Interaction Laboratory, and other campus units. Students have access through cooperative arrangements and programs to the resources of Archives II, the National Agricultural Library, the Library of Congress, and other prominent research facilities.

Students in History have access to the resources of the Library of Congress, the National Archives, the National Library of Medicine, the Folger, the US Holocaust Memorial

St. Jean, Beth
Vitak, Jessica

Adjunct Professor
Freeney, Maralita
Roderer, Nancy
Wester, Paul

Visiting Professor
Kurtz, Michael
Srikantaiah, Taverekere

Lecturer
Heger, Kenneth
Lawley, Katy Newton
Simmons, Wendy
Winter, Susan

University Affiliate
Punzalan, Ricardo L.

Museum, Dumbarton Oaks, the Hellenic Center and other research centers, archives, and library in the Washington DC area.

Financial Assistance

The College of Information Studies and the Department of History make available a limited number of teaching and/or graduate assistantships for master's students, including students in the HILS dual-degree program. These assistantships are awarded on the basis of merit, staffing needs, and budget. Neither academic unit extends guaranteed awards.

For more information on financial aid options from the College of Information Studies, please visit the Financial Aid section of the College of Information Studies website.

Contact Information

College of Information Studies
Student Services Office
Room 4120 Hornbake Library Building, South Wing
University of Maryland
College Park, MD 20742-4345
(301) 405-2038
Website: http://ischool.umd.edu/mls_specializations#History and Library Science
Email: mlsprogram@umd.edu

Dr. Marsha L. Rozenblit
Director of Graduate Studies
Department of History
2115 Francis Scott Key Hall
University of Maryland
College Park, MD 20742-7315 USA
(301) 405-4267
http://www.history.umd.edu/graduate.html

Jodi Hall, Program Manager
Department of History, 2115 Francis Scott Key Hall, University of Maryland, College Park,
MD 20742
Telephone: 301-405-4268
jlhall@umd.edu

Lindsay Sarin, MLS Program Manager
Room 4105 Hornbake Bldg, South Wing 4130 Campus Drive
College of Information Studies College Park,
MD 20740
Telephone: 301-405-2038
mlsprogram@umd.edu

ischool.umd.edu

Courses: INST HIST LBSC INFM

Human-Computer Interaction (HCIM)

Faculty:

Dean
Preece, Jennifer J.

Abstract

As the world grows increasingly more dependent on new technologies, the need has never been greater to create easy-to-use, meaningful technologies for diverse populations. Today, technology is an integral part of the lives of individuals everywhere; it

touches every aspect of the ways in which people learn, work and play. The Master of Science in Human-Computer Interaction degree integrates information studies, computer science, education, psychology and engineering to prepare HCI leaders of the future.

Through coursework and research experiences, students in this program will develop skills in:

Fundamentals of human-computer interaction

Advanced research methods

Usability analysis and testing

Social computing strategies and technologies

Technology design

Electives, individual research experiences and projects will allow students to develop their own specialties within HCI.

Graduate Director
Elmqvist, Niklas

Professor
Druin, Allison J.
Preece, Jennifer J.

Associate Professor
Elmqvist, Niklas
Golbeck, Jen

Assistant Professor
Chetty, Marshini
Findlater, Leah

Admissions Information

Admission to the Master of Science in Human-Computer Interaction (HCIM) is competitive. Applicants must have a baccalaureate degree from a regionally accredited college or university with a minimum "B" or 3.0 average on a 4.0 scale on all academic work attempted for consideration.

The Admissions Portfolio

Applications for admission are evaluated on the basis of these criteria:

- Strength of academic record
- Strength of the three recommendations/evaluations submitted on one's behalf from persons competent to judge probable success in graduate school
- Acceptable scores on the General Test of the Graduate Record Examination (scores must be no older than five years at the time of application)
- Response to admissions question: "What artifact do you regularly use that you like or you really don't like?" Answers to this question must include a visual representation and a text description explaining the reason behind your selection, totaling no more than 5 pages.
- Admissions Statement: Please address how the HCIM will support your educational and career goals.

Application Deadlines

Application Requirements

1. Strength of academic record
2. Strength of the three recommendations/evaluations submitted on one's behalf from persons competent to judge probable success in graduate school

3. Acceptable scores on the General Test of the Graduate Record Examination (scores must be no older than five years at the time of application). For more information on the GRE waiver please visit the College of Information Studies website at ischool.umd.ed.
4. Response to admissions question: "What artifact do you regularly use that you like or you really don't like?" Answers to this question must include a visual representation and a text description explaining the reason behind your selection, totaling no more than 5 pages.
5. Admissions Statement: Please address how the HCIM will support your educational and career goals.

Degree Requirements

Master of Science in Human-Computer Interaction (HCIM)
The Master of Science in Human Computer Interaction (HCIM) is a unique cross-disciplinary degree program that integrates information studies, computer science, education, psychology and engineering to prepare future HCI leaders in industry, government, education and other sectors. Through coursework and research experiences, students in this program will develop skills in the fundamentals of HCI, advanced research methods, usability analysis and testing, social computing strategies and technologies, and technology design.

With the aid of an advisor, the HCIM student devises a plan of study to meet graduation requirements: three core courses, a required internship, a thesis or capstone project, and elective courses for a total of 30 credit hours.

Core Courses

The core courses introduce a broad range of concepts related to HCI and provide the necessary background for more specialized courses and the completion of the thesis or capstone project.

INST630 Introduction to Programming for Information Professionals (3 credits)

INST631 Fundamentals of Human-Computer Interaction (3 credits)

INST632 Human-Computer Interaction Design Methods(3 credits)

INST701 Introduction to Research Methods (3 credits)

Required Courses

In addition to the core courses, students must complete the following:

INST717 Internship in Human-Computer Interaction (3 credits)

INST799 Thesis or INST775/INST776 Capstone Project (6 credits)

Elective Courses

Students will take 12 credits of elective courses in the following areas: Information Policy, Information Ethics, Users and Use Context, Information and Universal Usability, Information Environments.

Facilities and Special Resources

The College operates four research centers and labs: the Human-Computer Interaction Lab (HCIL), the Information Policy and Access Center (iPAC), the Cloud Computing

Center (CCC), and the Center for Advanced Study of Communities and Information (CASCI).

Financial Assistance

Contact Information

For more information, please contact the HCIM program coordinator. Brochures about the program are available on request.

Carlea Holl-Jensen
HCIM Program Coordinator
2117A Hornbake Library, South Wing,

4130 Campus Drive,
College Park
MD 20742
Telephone: 301-405-2769
cholljen@umd.edu

http://ischool.umd.edu/hcim

Courses:

Industrial Organizational Psychology (MPIO)

Faculty:

Abstract

The University of Maryland Master's of Professional Studies in Industrial Organizational Psychology provides rigorous training in the scientific principles and methods in IO Psychology while also increasing graduates' capacity to influence the way work is done, to apply evidence-based best practices, and to ask and answer questions that matter in the workplace. Students take 10 courses (two per term) over the course of 15 months. Courses are taught in the evenings at the College Park campus and through pre-recorded online lectures. This program is designed for working professionals who desire advanced knowledge in industrial and organizational psychology to enter, advance, or expand their career options.

Admissions Information

The Masters in Industrial Organizational Psychology program offers Fall admissions only. The application deadline for Fall enrollment is May 15th, 2016. International student application materials are due March 15th, 2016. Invitations to interview for the program will be sent to select students by July 1, 2016. UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS). Additional Requirements can be found here: http://oes.umd.edu/industrial-organizational-psychology/iopsyc-admission

Application Deadlines

Application Requirements

Applicants are asked to submit a statement of purpose, undergraduate transcripts, two letters of recommendation, and a resume or CV. GRE scores are not required.

Degree Requirements

Industrial/Organizational Psychology (MPS)

Facilities and Special Resources

Courses follow a blended format with classes taking place both face to face and online. In person classes are held at the College Park campus in the evenings.

Financial Assistance

Contact Information

Juliet Aiken, Ph.D. Director
Biology-Psychology Building
MD 20740
Telephone: 301-405-7861
jraiken@umd.edu

http://psyc.umd.edu/graduate/mps-industrial-organizational-psychology

Courses:

Information Management (INFM)

Abstract

The Master of Information Management (MIM) program prepares students to be leaders in the use of information and technology in an organization. Drawing from management, computer science, information systems, and information science, the MIM program provides students with the skills and knowledge to successfully meet users' information needs, lead efforts to develop organizations' information management capabilities, develop and deploy emerging technologies, and manage high-value information resources.

The MIM program integrates elements of management, computing, and information science to address critical social, economic, legal, and policy challenges associated with supporting information use by individuals and organizations. Its goals include:

- Preparing professionals for leadership positions that bridge the gap between technology-oriented staff, functional personnel, and management;
- Addressing the growing need for skilled information professionals who can strategically manage information and technology assets to fulfill critical information needs in organizations.
- Providing leadership in the information management field through the study of ethical, political, social, and technical issues related to information management in modern society.
- Assisting organizations in the formation of information policies, development and application of information systems and services, and the use of information management technologies and methods.

The MIM curriculum consists of 36 credits (12 courses) of graduate-level coursework in information management and related subjects, including a balanced mix of required and elective courses. The courses are integrated into four main blocks:

- Core courses form the foundation of the program and build a common platform among a diverse group of students who bring different professions, perspectives, cultures, and experiences to the classroom;
- Specialized courses in Management and Information Technology enable students to build advanced skills and knowledge and to develop the expertise required in the information field;

Faculty:

Dean
Preece, Jennifer J.

Associate Dean
Weeks, Ann C.

Professor
Butler, Brian
Marciano, Richard
Oard, Douglas William

Associate Professor
Lin, Jimmy
Elmqvist, Niklas
Golbeck, Jennifer
Jaeger, Paul T.
Wang, Ping

Assistant Professor
Chetty, Marshini
Findlater, Leah
Frias-Martinez, Vanessa
Shilton, Katie
Tausczik, Yla
Vitak, Jessica
Wiggins, Andrea

Adjunct Professor
Dearstyne, Bruce W.
Killam, William
Rhoads, Vera
Sahaskabudhe, Vikas

Visiting Professor
Kurtz, Michael
Srikantaiah, Taverekere

- Practicum courses allow students to connect theory from their learning experience to real-world settings through projects carried out in partner organizations;
- Elective courses provide flexibility to the program and allow students to pursue their own interests and specific needs in greater depth.

Senior Lecturer
Diker, Vedat

Lecturer
Lawley, Katy Newton
Weaver, Kathy
Winter, Susan

The Master of Information Management degree courses are available at the College Park campus (College Park, Maryland), at the Universities at Shady Grove campus (Rockville, Maryland), and online.

Admissions Information

Applications for admission to MIM program are evaluated on the basis of the following criteria:

- A baccalaureate degree from a regionally accredited college or university with a minimum "B" or 3.0 average on a 4.0 scale on all academic work attempted for consideration;
- Strength of the three (3) recommendations/evaluations from persons able to judge probable success in graduate school;
- Strength of targeted applicant essay describing why you are interested in the Masters of Information Management program and why this program is a good fit for your professional/career goals (in your essay, consider answering the following questions):
    - What do you see as the most significant opportunities for you in the information management field?
    - What about your background, education, or expertise makes you well suited to take advantage of the opportunities that you see?
    - What have you done in the past and what do you plan to do in the future to advance your career in the information management?
- Acceptable scores on the General Test of the Graduate Record Examination (GRE) or the Graduate Management Admission Test (GMAT);
- International applicants are required to submit the TOEFL or IELTS scores;
- Potential for leadership and innovation in information management as reflect in previously earned graduate degrees and work experience;

Application Deadlines

Fall:
Applicants are highly encouraged to apply as early as possible for best consideration. February 1 (**February 1 preferred**) .
February 1 .
Spring:
Applicants are highly encouraged to apply as early as possible for best consideration. October 1 (**October 1 preferred**) .
Summer:
Applicants are highly encouraged to apply as early as possible for best consideration. February 1 (**February 1 preferred**) .

Application Requirements

Applicants to the MIM program must submit the following documents:

- Graduate School application
- Official transcripts from each college or university attended
- 500-word targeted essay
- Current resume / CV
- Three (3) recommendations/evaluations
- Score report on the General Test of the Graduate Record Examination (GRE) or the Graduate Management Admission Test (GMAT)
- International applicants are required to submit the TOEFL or IELTS scores

Please visit the MIM Admission page for more information about applying to the MIM program.

Degree Requirements

Masters of Information Management (MIM)

Successful completion of the MIM degree requires that students complete 36 credit hours of academic work with at least a B average (3.0 GPA). Full-time students typically complete the program in 18 or 24 months, depending on whether they take an internship. Part-time students typically complete the program in two to three years. Students may take courses in daytime and evening and may switch between part-time and full-time enrollment. However, all coursework must be finished within five calendar years of the first registration.

All MIM students must complete four core courses, which provide a foundation of skills and knowledge related to information, technology, user analysis, and management. These courses must be completed within student's first 18 credits in the program. They allow students to determine which aspects of information management they find most interesting and useful. Below is a list of the MIM core courses:

- INFM 600 Information Environments - Role and function of information in organizations; organizational environment and its influence on internal and external communication, organizational structure and management, organizational culture, information flow, organizational identity. Shared mental models and group decision ma king. Differences among types of organizations. Information policy.
- INFM 603 Information Technology and Organizational Context - Application of communication and information technologies to support work processes, including technology-enhanced communication networks, computer-supported collaborative work, decision-support systems, interactive systems, and systems analysis. Acquisition of information systems and their integration into the organization.
- INFM 605 Users and Use Context - Use of information by individuals. Nature of information. Information behavior and mental models. Characteristics of problems, task analysis, problem solving, and decision making. Methods for determining information behavior and user needs. Information access. Information technology as a tool in information use.
- INFM 612 Management of Information Programs and Services - Administration of information programs, services, and projects, including the role of leadership in management; developing mission, vision, and goals; providing effective management for results; managing professionals; financial management; and professional conduct and ethical issues.

After completing the MIM core courses, all students are required to complete a set of electives that provide depth of knowledge in one or more areas of information management expertise. To help students satisfy this requirement, the MIM program offers informal specializations which provide students with examples of ways their MIM elective coursework can be organized to meet their educational and professional goals.The following specializations are available in the MIM program:

- Data Analytics
- Strategic Management (pending approval Fall 2015)
- User Experience (pending approval Fall 2015)
- Technology Development (pending approval Fall 2015)
- Information Management Research
- Community Analytics and Policy
- Archives and Digital Curation

MIM students who choose to design their own specializations prepare an individualized program plan. This option gives students the opportunity to combine technical and managerial coursework to create a unique program of study customized to their interests and needs.

Students are also required to complete a two-semester long capstone project (INFM 736 and INFM 737) that provides an opportunity for them to work with iSchool clients and demonstrate skills and knowledge learned during their course of study. (INFM 736 is taken in Fall and INFM 737 in Spring semesters).

Facilities and Special Resources

The College operates five research centers and labs: the Human-Computer Interaction Lab (HCIL), the Information Policy and Access Center (iPAC), the Center for Advanced Study of Communities and Information (CASCI), the Cloud Computing Center (CCC), and the Digital Curation Innovation Center (DCIC).

iSchool faculty and doctoral students also participate in or have affiliations with the University of Maryland Institute for Advanced Computer Studies (UMIACS), the Maryland Institute for Technology in the Humanities (MITH), and the Computational Linguistics and Information Processing Laboratory (CLIP), as well as the Departments of Computer Science, English, and Sociology, the Robert H. Smith School of Business, and the College of Education.

The College also operates a student computer lab for currently enrolled students.

Faculty and students participate in cooperative research with staff of the University Libraries, the Human-Computer Interaction Laboratory, and other campus units. Students have access through cooperative arrangements and programs to the resources of Archives II, the National Agricultural Library, the Library of Congress, and other prominent research facilities.

Financial Assistance

For more information on merit-based aid, please visit the Financial Aid section of the College of Information Studies website.

Contact Information

For more information about applying to the MIM program, please contact the iSchool Student Services Office at ischooladmission@umd.edu.

Please visit the College of Information Studies website for details on upcoming Information Sessions or Open House programs.

Student Services Office

College of Information Studies
4110 Hornbake Building, South Wing
University of Maryland College Park
MD 20742
Telephone: (301) 405-2038
Fax: (301) 314-9145
ischooladmission@umd.edu

http://ischool.umd.edu

Courses: INFM INFM INST

Information Studies (INFS)

Abstract

The Ph.D. in Information Studies (INFS) program at University of Maryland's College of Information Studies (Maryland's iSchool) offers an interdisciplinary approach to research and teaching provided by leading faculty at this highly respected public research university. Small classes and wide-ranging research projects enable students to work closely with faculty mentors to gain experience in identifying knowledge gaps, investigating both theoretical and practical solutions, evaluating results, and creating and disseminating new knowledge. A range of required research courses, doctoral seminars, and electives chosen by the students and their faculty mentors provide both the structure necessary for individuals to become successful researchers and the flexibility that allows them to pursue the research areas about which they are most passionate.

Maryland's iSchool is at the center of groundbreaking research in the fast-moving field of Information Studies. With a multidisciplinary faculty studying such diverse topics as Information Policy, Public and Academic Libraries, Digital Curation, Human-Computer Interaction, Social Computing, Citizen Science, Digital Innovations, and Health Informatics, the iSchool cultivates doctoral students from a wide range of backgrounds. The PhD program offered at the iSchool is an interdisciplinary program that provides students with training in theory, research, and pedagogy as preparation for original research in the field of Information Studies.

The iSchool's location near Washington, DC, the information capital of the world, offers unparalleled opportunities for students to pursue research and employment opportunities. Students have opportunities to work on research projects that lead to published papers, as well as benefit from one-on-one mentoring relationships with faculty members. Graduates of the program have accepted positions at leading universities and research institutions around the world.

Admissions Information

The College of Information Studies will review your application upon receipt of your completed application forms, transcripts of all academic work attempted, Graduate Record Examination scores, and letters of recommendation. If the doctoral committee needs further information, we will contact you. New doctoral students generally enter the College at the beginning of the fall semester.

Detailed Application Requirements

Transcripts for all undergraduate and graduate work. Official transcripts must be sent directly from all of your undergraduate and graduate institution(s).

Graduate Record Exam (GRE). Scores must be sent directly from ETS. Our institution code is 5814 and our department code for all programs is 4701. The GRE is required, and must have been taken within five years of the application deadline. We do not waive GRE scores under any circumstances. Please do not write to us to request a waiver.

Three Letters of Recommendation. Three recommenders must submit their recommendations directly to the Graduate School. It is preferable to request at least one letter from a former professor who is able to give an in-depth evaluation of the strengths and weaknesses of your academic work.

Statement of Goals, Research Interests, and Experiences. Your statement should address the following questions: (1) What is the specific area of your research interest? How have you developed your interest in this area? (2) What skills and/or prior experience that you have can help you pursue your research interest? (3) Which faculty members at Maryland's iSchool would you be interested in working closely with, and

Faculty:

Dean
Butler, Brian

Associate Dean
Weeks, Ann C.
Winter, Susan

Director
Wang, Ping

Professor
Bertot, John
Butler, Brian
Druin, Allison J.
Jaeger, Paul T.
Marciano, Richard
Oard, Douglas William
Preece, Jennifer J.

Associate Professor
Elmqvist, Niklas
Golbeck, Jen
Kraus, Kari Michaele
Subramaniam, Mega M.
Wang, Ping

Assistant Professor
Ahn, June
Chetty, Marshini
Clegg, Tamara
Findlater, Leah
Frias-Martinez, Vanessa
Punzalan, Ricardo
Shilton, Katie
St. Jean, Beth
Tausczik, Yla
Vitak, Jessica
Wiggins, Andrea

Visiting Professor
Kurtz, Michael
Srikantaiah, Taverekere

Senior Lecturer
Diker, Vedat

Lecturer
Lawley, Katy Newton
Weaver, Kathy

Professor Emeritus
Lowry, Charles B.
Soergel, Dagobert

why? (4) What are the goals you would like to achieve in your doctoral study at Maryland's iSchool? What is your plan to achieve your goals? (5) What kind of career would you like to develop after earning your Ph.D.?

Current Resume. Your resume or CV should list your educational and work experience as well as any publications, awards, or other notable accomplishments.

Application Deadlines

Fall:
Domestic Applicants: Applications must be received by December 1 .
International Applicants: Deadline for applications and the submission of all supporting documentation November 15 .

Application Requirements

1. Transcripts for all undergraduate and graduate work
2. Graduate Record Exam (GRE)- Scores must be no older than five years. No waivers granted.
3. Three Letters of Recommendation
4. Statement of Goals,Research Interests, and Experiences (addressing specifically the five questions above)
5. Current Resume
6. All international applicants must submit official TOEFL or IELTS scores.

Degree Requirements

Doctor of Philosophy in Information Studies (Ph.D.)

Doctoral students must complete a minimum of 27 graduate credit hours at the University of Maryland (or 30 hours if a basic statistics course has not been taken before matriculation). Course work will be taken in three areas of study: Information Studies (6 credit hours), Research Methods and Design (12 credit hours), and specialized area(s) (9 credit hours). Milestones within the program include first year review, integrative paper, dissertation proposal, and dissertation.

Facilities and Special Resources

The College operates four research centers and labs: Center for the Advanced Study of Communities and Information (CASCI), Digital Curation Innovation Center (DCIC), Human-Computer Interaction Lab (HCIL), and Information Policy and Access Center (iPAC). iSchool faculty and doctoral students also participate in or have affiliations with the University of Maryland Institute for Advanced Computer Studies (UMIACS), the Maryland Institute for Technology in the Humanities (MITH), and the Computational Linguistics and Information Processing Laboratory (CLIP), as well as the Departments of Computer Science, English, and Sociology, the Robert H. Smith School of Business, and the College of Education.

Financial Assistance

Information on the availability of financial assistance is available on the Ph.D. program's website at http://ischool.umd.edu/phd. The College seeks to offer funding to entering doctoral students throughout their study in the doctoral program, contingent on factors such as successful progress through the doctoral program, likelihood of timely completion of the doctoral program, qualifications, and the availability of funding.

Contact Information

For specific information on the academic programs available in the College of Information Studies, admission procedures, or financial aid, contact:

Student Services Office
4110 Hornbake Building, South Wing
University of Maryland
4130 Campus Dr.

College Park
MD 20742
Telephone: 301-405-2038
Fax: 301-314-9145
ischooladmission@umd.edu

http://ischool.umd.edu/phd

Courses:

Interpreting (MPIN)

Faculty:

Acting Director
Parry-Giles, Shawn J.

Abstract

The Master of Professional Studies in Interpreting (MPS in Interpreting) is designed to equip students with the required competencies to compete successfully for work as conference interpreters or community interpreters.Example skills include specialized work in both the consecutive and simultaneous modes in health, legal and political settings, for major corporations, international organizations, government ministries, and international, federal, and state courts requiring simultaneous capability.

The MPS in Interpreting is a two-year, 44 credit program. In the first year, you begin to develop high-level skills in consecutive interpretation (oral rendering after the speaker pauses). In the program's second year, you build on these fundamental skills and may learn simultaneous interpreting, while specializing in conference interpreting, or public service interpreting. Simultaneous interpreting may be selected as an elective in the public service interpreting track.

Admissions Information

For complete Admission Information, please visit: http://oes.umd.edu/professional-programs/interpreting-translation/gsit-admission-information

Application Deadlines

Application Requirements

Degree Requirements

Master of Professional Studies in Interpreting (MPIN)
The MPS in Interpreting is a two-year, 44 credit program. In the first year, you begin to develop high-level skills in consecutive interpretation (oral rendering after the speaker pauses). In the program's second year, you build on these fundamental skills and may learn simultaneous interpreting, while specializing in conference interpreting, or public service interpreting. Simultaneous interpreting may be selected as an elective in the public service interpreting track.

Graduate Certificate of Professional Studies in Consecutive Interpreting (Z080)
The Graduate Certificate of Professional Studies in Consecutive Interpreting (GCPS in Consecutive Interpreting) is designed to equip you with the knowledge and skills required for entry-level work in the interpreting profession. Examples include serving as dialogue

interpreters for non-specialized content in community, health, legal, and political settings. You will begin to develop high-level skills in consecutive interpreting (oral rendering after the speaker pauses) and will be grounded in the tenets of the profession, including professional conduct and ethics, as you are guided through the steps needed to advance your professional skill set.

The GCPS in Consecutive Interpreting is a one-year 21-credit program offering instruction in the fundamental skills of consecutive interpreting in interpreting studies, the interpreting profession, and intercultural communication.

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/interpreting-translation

Courses:

Jewish Studies (JWST)

Abstract

The Jewish Studies Program offers both a Masters Degree in Jewish Studies, and a Graduate Certificate in Jewish Studies.

The Masters Program in Jewish Studies is designed to offer students broad, interdisciplinary, graduate-level training in Jewish Studies, as well as in-depth focus on some aspect of the Jewish experience. The curriculum draws on the strengths of the Jewish Studies Program at Maryland, especially Jewish History, Bible, Jewish Literature and Cultural Studies (particularly in the ancient and modern periods), Yiddish, Philosophy, Religious Studies, and Israel Studies. In addition, students take courses in cognate fields outside of Jewish Studies in consultation with their advisors. The extremely strong, and still growing, library collection (rivaled in the mid-Atlantic region only by the Library of Congress), and our proximity to the National Archives, the Library of Congress, the U.S. Holocaust Memorial Museum, and other museums and institutions make the University a prime location for graduate Jewish Studies.

The Post Baccalaureate Certificate in Jewish Studies offers students already enrolled in graduate programs at the University to receive training in Jewish Studies. The program draws on faculty in History, English, Philosophy, Hebrew, and other departments and programs.

Admissions Information

Application Deadlines

Fall:
Applications must be received by December 15 (**December 15 preferred**) .
Spring:
This program **does not** accept applications for this semester.

Faculty:

Chair
Manekin, Charles H.

Professor
Lapin, Hayim
Manekin, Charles H.
Peri, Yoram
Rozenblit, Marsha L.

Associate Professor
Cooperman, Bernard Dov
Grossman, Maxine
Jelen, Sheila
Zakim, Eric S.

Assistant Professor
Hazkani, Shay
Manekin, Rachel
Suriano, Mathew

Research Associate Professor
Feuer, Avital
Scham, Paul

Affiliate Professor
Cypess, Sandra M.
Fox, Nathan A.
Glass, James M.
Harris, James F.
Holum, Kenneth G.
Igel, Regina
Selden, Steven
Sosnowski, Saul
Telhami, Shibley
Zilfi, Madeline C.

Affiliate Associate Professor
Borrut, Antoine

Application Requirements

- GRE
- 3 Letters of Recommendation
- Academic Writing Sample
- Personal Statement
- Transcripts

Felbain, Leslie
Freidenberg, Judith N.
Strauch, Gabriele L.
Wien, Peter

Visiting Assistant Professor
Mahalel, Adi

Professor Emerita
Berlin, Adele
Venit, Marjorie S.

Degree Requirements

Graduate Certificate in Jewish Studies ()
In order to be eligible for the Jewish Studies Certificate Program a student must be accepted into or currently enrolled in a master's or doctoral degree program at the University of Maryland.

Students must take four graduate level courses (12 credits) in Jewish Studies. At least six of the 12 credits must be in a different discipline than the student's home department. All students take JWST 600, General Seminar in Jewish Studies, plus at least two other graduate readings or research courses at the 600-800 level. Only one 400-level course can count toward the certificate. Students must work with an advisor to determine which courses best suit their particular needs.

Master of Arts (M.A.)
1. Hebrew Language. It is desirable that students have achieved the proficiency-level corresponding to four semesters of university-level Hebrew, and have achieved the level of six semesters of university-level Hebrew by the time they have completed the program. Courses in Hebrew language will not count toward the 30 credits needed for the degree. Students will be asked to demonstrate their knowledge of modern academic Hebrew by examination, or through a research project making extensive use of Hebrew-language materials.

2. Course of Study.

Core Distribution: (a) JWST 600, General Seminar in Jewish Studies (3 credits), which introduces students to the fields, methods, and problems of Jewish Studies as a cluster of disciplines; (b) one course each in the general areas of Jewish History, Jewish Thought or Religion, and Jewish Literature, normally by enrolling in JWST 648, Readings in Jewish history; JWST 658, Readings in Jewish Thought; and JWST 678, Readings in Jewish Literature (9 credits total). In some cases, equivalent courses in these areas can be substituted.

Specialization: 4 courses (12 credits) in consultation with the advisor. Students may opt to write an MA Thesis (6 credits). Non-thesis students prepare a dossier of 2 major research papers or their equivalent to be evaluated by an examining committee.

Cognate Studies: Two courses (6 credits) from outside Jewish Studies in the discipline(s) related to the student's area of specialization.

Facilities and Special Resources

The University's libraries hold over 3,000,000 volumes and house among the strongest holdings in Judaic Studies in the Mid-Atlantic region. In addition to the outstanding holdings of the Library of Congress, the area also offers the specialized resources of the Dumbarton Oaks, the National Archives, the Smithsonian Institution, the U.S. Holocaust Memorial Museum, and numerous other scholarly, cultural, and political resources. Through the Consortium of Institutions in the Washington D.C. area, University of

Maryland graduate students may enroll in courses at other universities for graduate credit.

Financial Assistance

MA applicants are eligible for University-wide fellowships. In addition, the Jewish Studies program may award up to two fellowships per year to outstanding Masters students.

Limited funds may be available for outstanding certificate students.

Contact Information

For more information, please contact the Prof. Charles Manekin, Director of the Meyerhoff Center and Program fo Jewish Studies.

The Joseph and Rebecca Meyerhoff Program and Center for Jewish Studies
4141 Susquehanna Hall College Park
MD 20742
Telephone: 301 405 4975
Fax: 301 405 8232
jwst-contact@umd.edu

http://www.jewishstudies.umd.edu

Courses:

Journalism (JOUR)

Abstract

The Philip Merrill College of Journalism offers a Master of Journalism (JOMJ), a Master of Arts in Journalism (JOUR) and a Doctor of Philosophy in Journalism Studies (JOST). The College accepts full-time students to the master's program, which is designed to be completed in 12 to 16 months. There are specialized tracks in multi-platform journalism and broadcast journalism. The College also offers a highly individualized program for veteran journalists, which may be completed on a part-time basis. The Ph.D. in Journalism Studies is a full-time, research-oriented program that prepares students for careers in university teaching, academic and industry research, and media consulting. For more information, visit: http://merrill.umd.edu/

Admissions Information

Applicants seeking admission to the master's program must hold a bachelor's degree from a recognized institution of higher learning. Undergraduate study of journalism and professional experience in journalistic fields are not required. Completion of the general aptitude portion of the Graduate Record Examination is required and three letters of recommendation must be submitted. Applications for the master's program are considered for admission in the Summer or Fall semesters. Students beginning the master's program in the summer can graduate within 12 months, whereas students beginning in the fall can graduate in 16 months. Students on the broadcast journalism track must start in the summer. Multi-platform students may opt to begin the program in summer or in fall. The deadline to apply for admission to the master's program for the Summer or Fall semesters is February 1. Please note that applications submitted after the deadline will not be considered until the following year, and all supporting application materials must be received by February 1. Applications for the doctoral program (Ph.D.) are considered only for Fall semester enrollment. The deadline to apply to the doctoral

Faculty:

Dean
Dalglish, Lucy A.

Associate Dean
Lorente, Rafael

Professor
Feldstein, Mark
Klose, Kevin
Moeller, Susan
Oates, Sarah
Priest, Dana
Steiner, Linda
Stepp, Carl Sessions

Associate Professor
Chinoy, Ira
Hanson, Christopher
Nelson, Deb
Yaros, Ron

Assistant Professor
Chadha, Kalyani
Diakopoulos, Nick

Professor of Practice
Solomon, George

Visiting Professor
Banisky, Sandy
Blackistone, Kevin
Walker, Leslie

program is February 1, and all supporting application materials must be received by this date. The program does not take applications to begin in the Spring semester.

Application Deadlines

Fall:
International and domestic applications to the doctoral program must be received by January 15 .
International and domestic applications to the master's program must be received by February 1 .
Spring:
This program **does not** accept applications for this semester.
Summer:
International and domestic applications to the master's program must be received by February 1 .

Application Requirements

For M.A./M.J. Program

1. GRE General
2. 3 Letters of Recommendation
3. 3 Writing Samples
4. Personal Statement of Goals and Experiences
5. Official Transcripts
6. Resume or Curriculum Vitae (recommended)
7. International applicants: TOEFL or equivalent test of English unless the student holds a degree from a program taught in English.

For Ph.D program

1. GRE general
2. 3 Letter of Recommendations, preferably from academics.
3. Statement of Research Interests
4. Official Transcripts
5. Resume or Curriculum Vitae
6. International applicants: TOEFL or equivalent test of English unless the student holds a degree from a program taught in English.
7. Academic writing sample, if available (not required)

Degree Requirements

Master of Journalism/Master of Arts (M.J./M.A.)

The master's degree is typically a 36-credit program (30 credits are required for students in the Returning Journalists specialization). The MJ is a non-thesis degree and is the preferred program of those looking to enter the journalism profession. Students pursuing an MA take six credits preparing a thesis. Students admitted to the standard master's program in multi-platform or broadcast journalism are not required to possess prior training or experience in the field. Students admitted to the returning journalist program, however, must have significant professional experience. Students who enter the MJ program with significant professional newsroom experience can request to opt out of the two required 500-level courses. Students on the 12-month track begin in the summer and take six credits each in summer session one and two, and 12 credits each in fall and spring. Students who start in the fall semester take their coursework fall, spring, and the following fall. The program's capstone experience is the Capital News Service, where students serve as full-time reporters in news bureaus in Washington and Annapolis, at the college's TV station, UMTV, and from our state-of-the-art multiplatform news facilities in Knight Hall.

For more information on our programs, visit: http://merrill.umd.edu/academics/masters-programs/

For more information on the Returning Journalist program, see: http://merrill.umd.edu/academics/masters-programs/

Lecturer
Clayton, Cassandra
Davidsburg, Joshua
Flynn, Adrianne
Harvey, Chris
Huffman, Diana
Kopen Katcef, Sue
Mussenden, Sean
Swain, Bethany

Professor Emerita
Beasley, Maurine
Rogers, Carol Lombard

Professor Emeritus
Franklin, Jon
Gomery, Douglas
Newhagen, John E.
Roberts, Eugene L.

Associate Professor Emerita
McAdams, Katherine C.

Detailed information on the requirements of our programs can be found in the master's program handbook, available online at the bottom of:
http://merrill.umd.edu/academics/masters-programs/

Doctor of Philosophy (Ph.D.)

Maryland's Ph.D. in Journalism Studies is designed to prepare students for careers in university teaching, academic and industry research, and media consulting. The first two years of the program consist of coursework in theory, research methods, journalism, and an outside area of interest (such as Communications, Sociology, History, etc.). At the end of coursework, students take comprehensive examinations (in theory, cognate area, methodology, and in their areas of specialization). Students then conduct research and write the dissertation. Most successful candidates enter the program with a master's degree, but a master's degree is not a prerequisite for admission.

For more information on the doctoral program, see:
http://merrill.umd.edu/academics/phd-program/

Facilities and Special Resources

The University of Maryland is located just a few miles from Washington, the media capital of the world. Students and researchers have access to The Washington Post and USA Today as well as hundreds of Washington bureaus for newspapers, online news sites, and TV and radio news outlets from around the world. The Philip Merrill College of Journalism operates daily news bureaus in Washington, D.C., at the National Press Building a few blocks from the White House; in Annapolis, just a block from the Maryland State House; and on campus from two locations -- Knight Hall, our state-of-the-art building with multiple news labs and opportunities for multi-platform experimentation; and UMTV, a cable TV station that reaches more than 600,000 homes in central Maryland. The broadcast program is equipped with state-of-the-art digital editing systems used by students to produce a 30-minute nightly newscast. Opened in 2010, Knight Hall also brings all of the College's affiliated centers under one roof.

Centers

The Philip Merrill College of Journalism is home to a number of centers and programs designed to help professionals improve key aspects of journalism.

The Shirley Povich Center for Sports Journalism: Launched in 2012, the Povich center will "forge a path in sports journalism toward analyzing complex issues in athletics, to challenge and clarify society's avid participation in games as players and spectators." For more information: http://povichcenter.org/

The Hubert H. Humphrey Journalism Fellowships: The Humphrey fellowship is a special one-year program that brings international journalists to the University of Maryland to study. Fellows seek to strengthen their management and leadership skills and make professional contacts. The fellowship program is led by Serap Rada, who holds a Ph.D. in government and international relations from the University of Maryland. For more information: http://merrill.umd.edu/humphrey/

The Society for Features Journalism: Founded in 1947, the Society for Features Journalism (formerly the American Association of Sunday and Features Editors, or AASFE) is "dedicated to the quality of features in newspapers." The independently operated group sponsors an annual convention, a writing contest, regional workshops and a fellowship program designed to develop minority feature writers. It also publishes two magazines, "Style" and "Feedback." SFJ's membership of nearly 200 is limited to newspaper feature editors and Sunday section editors. For more information: http://featuresjournalism.org/

The National Association of Black Journalists (NABJ): NABJ is an organization of journalists, students, and media-related professionals that provides quality programs and services to and advocates on behalf of black journalists worldwide. Founded in 1975, NABJ is the largest organization of journalists of color in the nation. For more information: http://www.nabj.org/

Financial Assistance

The Philip Merrill College of Journalism offers a number of fellowships and scholarships, and there are additional opportunities at the College of Journalism and across campus for employment in graduate assistant positions.

Students admitted to the PhD program are typically offered assistantships within the College of Journalism. These currently include an annual stipend of approximately $18,000 (revised annually) and come with 24 credits of tuition remission (10 in the Fall, 4 in the Winter, 10 in the Spring) plus access to group health insurance. These assistantships require 20 hours of work per week for nine and a half months, typically in teaching or research.

Master's students interested in assistantships must apply to individual units across campus that have positions available. The number of hours per week and the stipend levels will vary by unit and by the nature of the position.

The College has several scholarships and fellowships to help master's students, PhD students, or both with the cost of study. These include the following awards: Graduate School Dean's Fellowships, John Story Cleghorn and Nona Reese Cleghorn Scholarship , Eleanor Merrill Graduate Fellowship, Lawrence L. and Lillie Z. Goldberg Scholarship, Mary Anne and Frank A. Kennedy Scholarship, the Maury Povich Sports Journalism Scholarship Fund, the Reese Cleghorn Journalism Excellence Scholarship, the Gridiron Foundation Journalism Scholarship, the Michael Gurevitch Journalism Scholarship, and the Professor Thomas J. Aylward Scholarship. Additional information is available at http://merrill.umd.edu/academics/masters-programs/fellowships-and-aid/

Travel funding for graduate students in the Journalism College is available via The Hiebert Journalism International Travel Award and the Gene Roberts Award.

This is in addition to a range of fellowships offered by the Graduate School: http://www.gradschool.umd.edu/funding/fellowships-awards/student-fellowships-awards

Contact Information

Specific information about the Journalism Program is available on request from:

David Watson, Asst. Dir., Graduate Studies
2206 Knight Hall,
University of Maryland-College Park
MD 20742
Telephone: (301) 405-2380
Fax: (301) 314-9166
dcwatson@umd.edu

http://merrill.umd.edu/

Courses:

Kinesiology (KNES)

Faculty:

Please note, the application deadlines and most information listed on this page are for the MA and PhD degrees in Kinesiology. For more specific information about the MPH degree with concentration in Physical Activity, refer to the Graduate Catalog listing: **Public Health: Masters of Public Health--Physical Activity**.

Abstract

A vital part of the School of Public Health, the Department of Kinesiology offers programs leading to the Master of Arts (thesis and non-thesis options) and Doctor of Philosophy degrees. Research emphases within the three broadly defined areas of exercise physiology, cognitive motor neuroscience, and physical cultural studies are offered. Within each of these cognate areas, students develop specialized programs with faculty guidance and consistent with faculty expertise. Details of faculty research interests and additional information can be found at the department website http://www.sph.umd.edu/KNES/

Admissions Information

Students may qualify for admission with a 3.0 GPA for M.A. or 3.5 GPA for Ph.D. programs, strong GREs, and a focused letter detailing academic and research goals as well as previous research experiences. In addition, each applicant should submit a minimum of three strong recommendations from people knowledgeable about the applicant's prior academic achievements and research potential. Appropriate background course work closely aligned with the intended research specialization is expected. Graduate faculty sponsorship is also necessary for admission; each faculty member has only a limited number of openings and only the most highly qualified applicants are selected. Faculty review of applications does not occur until all required parts of the application are received. This review is done in early January; therefore applicants are encouraged to have all their application materials submitted by January 1 for best consideration for admission and financial support.

Application Deadlines

Fall:
Applications must be received by January 15 (**December 15 preferred**) .
Spring:
Applications must be received by October 1 (**August 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

For all of our degrees, we require the GRE general test, three letters of recommendation (research/academic), and a statement of goals that includes research experiences and interests.

- **Admission Application for MA and PhD in Kinesiology:**

  Regardless of academic preparation, for the MA and PhD programs a qualified faculty member in the proposed Area of Study must be willing to sponsor and mentor the student prior to applying. Applicants should be able to speak with the graduate faculty member with whom they would prefer to study prior to submitting an application. Applicants are encouraged to visit the campus and make appointments to interview with faculty in the area of specialization.
  How to Apply:
  The University of Maryland's Graduate School accepts applications through its ApplyYourself/Hobsons application system. Before completing the application, applicants are asked to check the Admissions Requirements site for specific instructions.
  As required by the Graduate School, all application materials are to be submitted electronically and include a non-refundable application fee ($75) for each program to which an applicant applies.
  The electronic submission of application materials helps expedite the review of an application. Completed applications are reviewed by an admissions committee in each graduate degree program. The recommendations of the committees are

Chair
Hatfield, Bradley D.

Associate Chair
Dena Deglau

Graduate Director
Hagberg, James M.

Professor
Andrews, David L.
Clark, Jane E.
Hagberg, James M.
Hatfield, Bradley D.
Hurley, Bernard F.
Iso-Ahola, Seppo E.

Associate Professor
McDaniel, Stephen R.
Rogers, Marc A.
Roth, Stephen M.
Shim, Jae Kun
Smith, J. Carson

Assistant Professor
Chin, Eva
Gentilli, Rodolphe
Jette, Shannon
Miller, Ross H.

Research Assistant Professor
Dena Deglau
Friedman, Michael
Kiemel, Timothy L.

Instructor
Brown, Elizabeth Y.
Scott, Marvin W.

University Affiliate
Roberts, Jennifer D.

Professor Emerita
Ennis, Catherine D.
Hult, Joan S.

Professor Emeritus
Clarke, David H.
Dotson, Charles O.
Franks, Burleigh Don
Jeka, John J.
Kelley, David L.
Steel, Donald H.

Associate Professor Emerita
Phillips, Sally J.

Associate Professor Emeritus
Wrenn, Jerry P.

submitted to the Dean of the Graduate School, who will make the final admission decision. Students seeking to complete graduate work at the University of Maryland for degree purposes must be formally admitted to the Graduate School by the Dean. To ensure the integrity of the application process, the University of Maryland authenticates submitted materials through TurnItIn for Admissions. No materials should be sent to the department unless specifically directed by the office Depending upon the experience of the applicant there may be additional course work required to prepare the student for the graduate program in Kinesiology. Such course work will be determined by the faculty advisor. Application Deadlines for MA and PhD:
Fall International: January 15
Fall Domestic: January 15
Spring International: June 1
Spring Domestic: October 1

Degree Requirements

Master of Arts (M.A.)
Completion of the master's degree with thesis requires a minimum of 24 semester hours and six thesis credits. The M.A. non-thesis option requires a minimum of 27 semester hours, a three-credit project based on an independent scholarly investigation, and a final comprehensive examination. Students in both options work under the direction of a graduate faculty advisor and must complete, as a minimum, six semester hours in a cognate area, six semester hours in research processes, and twelve semester hours in supporting courses either in or outside of the department. If internships are selected as part of the individual program, the total credits will exceed the minimum 30 credits.

Doctor of Philosophy (Ph.D.)
The doctoral program is designed to prepare outstanding scholars in a research domain in Kinesiology. To complete the program, a student must provide substantial evidence of his or her ability to frame and complete original research.

A Ph.D. student's program is tailored to meet his or her academic goals, but all students will produce and follow a research plan and complete a minimum of 90 credit hours relevant to Kinesiology (including dissertation) beyond the bachelor's degree. The program of study includes research experiences, as well as courses in the cognate area, other supportive courses outside of the department that broaden or deepen one's knowledge, and courses in research and analytic processes. Students also are expected to engage in the culture of Kinesiology through active participation in seminars and other departmental activities and to develop teaching expertise in the subdiscipline. All Ph.D. students are expected to complete a dissertation, which is the culminating research experience and contributes to knowledge in kinesiology.

Master of Public Health--Physical Activity (M.P.H.)
The Master of Public Health (MPH) degree with a concentration in Physical Activity is a 43-credit professional degree, administered by the Department of Kinesiology. All MPH students with concentration in Physical Activity will complete five public health core courses, eight courses in the physical activity and related cognate area, an internship, and a capstone project.

For more information about the MPH in Physical Activity, see the Graduate Catalog listing: Public Health: Masters of Public Health--Physical Activity.

Facilities and Special Resources

The Department has three areas of specialization: Cognitive Motor Neuroscience, Exercise Physiology, and Physical Cultural Studies. Laboratories are maintained, which support original investigations in each of the three areas. Laboratories include equipment for measuring metabolic parameters, strength, body composition, postural sway, ground reaction forces, amount of physical activity in daily life, as well as muscle biopsies and movement analysis. The response of the human body to physical activity/exercise can be viewed through ECG, EEG, EMG and systematic behavior

observation systems. Each of the three research areas has interfaced computer hardware and software to support data collection and analysis. Collaborations with the School of Medicine at the Baltimore campus and with NIH often result in the availability of other facilities and equipment. All graduate students have access to computers and other forms of technology. Details and pictures of current facilities and equipment are available at our website: www.sph.umd.edu/KNES/.

Cognitive Motor Neuroscience Lab - Various tools provide students with opportunities to measure, postural sway, ground reaction forces, multi-digit pressing and moments in 3-D, and movement analysis. These tools include: (1) A three wall rear-projected monoscopic CAVE display system with three XGA digital projectors. The system is designed for standing humans to be immersed in a visual world to test questions about how the nervous system processes visual information to maintain upright stance. (2) A hydraulically-controlled moveable force platform for recording center of pressure and ground reaction forces inside the CAVE. (3) An Optotrak motion analysis system, capable of tracking up to 24 LEDs simultaneously for whole body analysis. (4) A touch plate consisting of a miniature force plate capable of resolving .01 N of force in three directions. (5) A Logitech 6D ultrasonic tracking system consisting of a control unit, two triangular receivers and one triangular transmitter. Each receiver provides three components of translation (x, y, z) and three components of rotation (yaw, pitch, roll) with a resolution of .006 cm. (6) A 16 channel EMG Neuraxon system for recording muscle activity. Because responses of the human body can be viewed through Electrocardiographic (ECG), Electroencephalic (EEG), and Electromyographic (EMG), we collaborate with the University of Maryland, School of Medicine at Baltimore and the National Institutes of Health. This results in the availability of other facilities and equipment whereby students may join forces on projects involving neuroimaging and virtual reality environments.

Exercise Physiology Lab The Exercise Physiology group has various laboratories capable of supporting a wide-range of exercise-related studies, including metabolic testing, Bod-Pod body composition, muscular strength and power testing, and various clinical blood-based assays. Moreover, the group collaborates with various nearby facilities for high-quality measurement of body composition, including muscle size, bone density, and visceral adiposity. A 6,000 sq. ft. training facility is fully equipped with aerobic exercise training equipment and 20+ Keiser strength training machines for all major muscle groups. In addition to these general facilities, the group maintains other specialized laboratories. The Functional Genomics Lab studies the role of genetic variation in disease susceptibility and the responses and adaptations of different individuals to various exercise programs. The lab has state of the art equipment for genetic analysis, including extensive computer resources. The Molecular Biology Lab has extensive scientific resources for examining the effects of exercise and inactivity on muscle, adipose, and other cell types utilizing both in vivo and in vitro approaches. website: www.sph.umd.edu/KNES/.

Physical Cultural Studies (PCS) advances the critically and theoretically-driven analysis of physical culture, in all its myriad forms. These include sport, exercise, health, dance, and movement related practices, which PCS research locates and analyzes within the broader social, political, economic, and technological contexts in which they are situated. More specifically, PCS is dedicated to the contextually based understanding of the corporeal practices, discourses, and subjectivities through which active bodies become organized, represented, and experienced in relation to the operations

of social power. PCS thus identifies the role played by physical culture in reproducing, and sometimes challenging, particular class, ethnic, gender, ability, generational, national, racial, and/or sexual norms and differences.

Financial Assistance

Teaching and research graduate assistantships are offered each academic year. At the present time, over two-thirds of the graduate students are financially supported. Teaching assistants work as discussion leaders and laboratory assistants as well as instructors in physical activity classes. Many research assistants are supported by grants. The department is active in seeking University fellowships for its outstanding applicants. Currently the department provides partial financial support for all graduate students who are selected to present their research at scholarly meetings.

Contact Information

For additional information and an application, contact:

Polly R. Sebastian Schurer, Graduate Coordinator
Department of Kinesiology 2351 SPH Building School of Public Health (Valley Drive)
College Park
MD 20742-2611
Telephone: (301)405-2453
Fax: (301)405-5578
knes-grad@umd.edu

http://www.sph.umd.edu/knes

Courses: KNES

Related Programs and Campus Units

Neuroscience and Cognitive Science

Engineering: Bioengineering

Landscape Architecture (LARC)

Abstract

The Master of Landscape Architecture (MLA) is a professional degree program that prepares students for work as academicians and practitioners. The three-year first professional degree curriculum is for students who have a bachelor's degree in a non-design field. The MLA is a degree that is accredited by the LAAB (Landscape Architecture Accreditation Board), which allows graduates to sit for the professional license exam (LARE). The two-year post-professional degree curriculum is for students who have a bachelor's degree in landscape architecture or a related design field. Through the required courses, concentration electives, and individual research, each student will acquire a thorough theoretical basis, grounding in methods and practices, and exposure to contemporary local and global issues. The required studio courses and the thesis or creative project, conducted with faculty and community partners, advances the knowledge base of landscape architecture through research and community outreach activities.

Our extensive hands-on training and real-world creative problem-solving approaches

Faculty:

Director
Myers, David N.

Associate Professor
Ellis, Christopher
Ellis, Christopher
Myers, David N.
Sullivan, John B. (Jack)

Assistant Professor
Chanse, Victoria
Cook, Kelly
Kweon, Byoung-Suk

Lecturer
Anderson, Ann
Ison, Arlie
Leonard, Jack
Nola, Dennis R.

provide you the knowledge, skills, and abilities needed to excel and make a difference. The studio experience provides an opportunity to implement ecological design solutions ranging from development, conservation, and restoration. From creating livable communities to solving environmental design problems, Landscape Architects are committed to helping shape the future while protecting the past.

The MLA program is interdisciplinary in its philosophy and its operation. Individual courses convey concepts and tools from diverse disciplines and studio, research, and outreach projects have a multi-discipline association. Project and research advisors come from faculty in Landscape Architecture, Plant Science, Environmental Science, Geography, Geology, American Studies, Architecture, Urban Studies and Planning, Historic Preservation, Real Estate Development, and other academic disciplines and professional partnerships.

Admissions Information

Applications received after October 1 for Spring admissions and after February 1 for Fall admissions may be considered, space permitting.

Application Deadlines

Fall:
Online applications are due February 1, 2011. Portfolios are due February 15, 2011 for all applicants, domestic and international .
Spring:
Applications for Spring 2012, including portfolio submissions, are due by October 1, 2011. Only Post-Professional degree candidates may apply for the spring term. .

Application Requirements

1. Minimum 3.0 GPA and Undergraduate transcripts
2. GRE test scores
3. 3 Letters of Recommendation
4. Portfolio of Creative Work*
5. Statements of: Goal, Research Interests and Experiences (Letter of Interest)

*__Portfolio__: The portfolio is a compilation of graphic, written or scored work that you have created or observed and recorded. This collection should show your interest and aptitude for the visual language of design. Expertise in design is welcomed but not required. The portfolio should illustrate your interests in a variety of areas related to landscape architecture and environmental design. This portfolio should be uploaded digitally with your application. If you have any questions please email Diana Cortez at dcortez@umd.edu. **Portfolios are due no later than the application deadline. PLEASE NOTE: Transcripts and financial information should be sent to: University of Maryland ESO-Graduate Rm 0130 Mitchell Building College Park, MD 20742.**

Degree Requirements

Master of Landscape Architecture (M.L.A.)

Three-Year First Professional Degree Curriculum (70 Credits + 6 credits @ 200-level, if required).
Students will be advised to take remedial Woody Plant Identification courses prior to arrival or in the first year of study at Maryland. The MLA Program requires these courses

in order to meet accreditation standards. Requirements (contact department for detailed curriculum):

Courses in Theory and History (12 Credits)
Courses in Studio Design and Planning (25 Credits)
Courses in Graphic Communication and Practice Technology (15 Credits)
Courses in Ecology and Plant and Soil Sciences (3 Credits + 6 credits of remedial courses)
Courses in Independent Study and Research, with Thesis or Creative Design project(15 Credits)

Two-Year Post-Professional Degree Curriculum (39 credits)
This curriculum is for those students with a Bachelor of Landscape Architecture or other approved environmental design degree. Requirements (please contact department for detailed curriculum):

Courses in Theory and History (6 Credits)
Courses in Studio Design and Planning (15 Credits)
Courses in Independent Study and Research, with Thesis or Creative Design project(18 Credits)

Facilities and Special Resources

The Master of Landscape Architecture program is accredited by the Landscape Architecture Accreditation Board (LAAB) of the American Society of Landscape Architects. The program maintains a balance between design theory and application in a professional degree curriculum. The MLA program builds upon the strengths of the Department of Plant Science and Landscape Architecture (PSLA) and the Landscape Architecture Program (LARC). The PSLA Department is composed of faculty members who specialize in landscape architecture, landscape history, ecology, plant science, urban forestry, turf and golf course management, and landscape management. It provides a strong, comprehensive grounding for landscape design, planning and preservation, landscape assessment, site and ecological systems analysis, plant identification, plant conservation, and plant pathology. Other environmental programs in the College of Agriculture and Natural Resources offer knowledge and practical insight into the science of ecology, ecological restoration, water and soil conservation, and forest management. The MLA builds on this collaboration through advanced courses, student advising, and the contribution of non-teaching programs such as lectures, symposia and research projects.

The Master of Landscape Architecture Program is located in the Plant Sciences Building on the College Park campus. Advanced individual computing facilities, personal drafting stations, scanning and printing facilities, and a model-making workshop are available 24 hours a day, 7 days a week, to every student in the MLA program.

Financial Assistance

A limited number of Graduate Assistantships are available to qualified students. These include Teaching, Research, and Administration Assistantships. Assistantships can be 9-month or 12-month appointments and include tuition remission (5 to 10 credits each semester, commensurate with GA appointment), an annual salary, health benefits, and in-state tuition, in exchange for 10 to 20 hours of work per week. Scholarships, fellowships, and other funding sources are available through a variety of external agents, such as the Landscape Architecture Foundation (LAF), the Garden Club of America (GCA), and others, including the following:

- Steven G. King Play Environments Scholarship: undergraduate or graduate students enrolled at LAAB-accredited schools. Award: $5,000.

- The Dangermond Fellowship: graduate students in the United States. Award: Up to three (3) $10,000 fellowships.
- Peridian International, Inc./Rae L. Price, FASLA Scholarship. Award: $5,000.
- The Douglas Dockery Thomas Fellowship in Garden History and Design: graduate student in the United States. Award: $4,000.

Go to http://www.laprofession.org/financial/scholarships.htm for more information.

Contact Information

Diana Cortez, Program Management Specialist
2139 Plant Sciences Building
College Park
MD 20742-4452
Telephone: 301-405-4359
Fax: 301-314-9308
dcortez@umd.edu

http://www.larch.umd.edu

David N. Myers, Ph.D., PLA, ASLA Associate Professor and Director
Landscape Architecture Program Department of Plant Science and Landscape Architecture
2146 Plant Science Building College Park MD 20742-4452
MD 20742-4452
Telephone: 301-405-4350
Fax: 301-314-9308
dnmyers@umd.edu

http://www.larch.umd.edu

Courses: LARC

Related Programs and Campus Units

Real Estate Development
Architecture
Urban Studies and Planning
Historic Preservation

Library Science (LBSC)

Abstract

The fully American Library Association (ALA) accredited Master of Library Science (MLS) program at the University of Maryland is a professional degree that provides students with a comprehensive foundation in both research and practice in library and information science. This foundation prepares students for careers in government, archives, museums, libraries, startups, and any organization engaged in information activities.

At the iSchool we seek students who will serve as the next generation of leaders in information science and who will succeed in the dynamic and evolving global information society.

Faculty:

Dean
Preece, Jennifer J.

Associate Dean
Weeks, Ann C.

Director
Diker, Vedat

Professor
Bertot, John
Butler, Brian
Druin, Allison J.

The MLS program is designed for students from a wide variety of academic and career backgrounds, and is flexible enough to accommodate students working full or part-time. Students can complete their MLS degree in-person, fully online, or through a hybrid approach.

Each student in the MLS Program selects one of our unique specializations. Students who pursue the "Individualized Program Plan" may create their own course plan. Specialization offerings include:

- Archives and Digital Curation
- Community Analytics and Policy
- Individualized Program Plan
- Diversity and Inclusion
- School Library
- Youth Experience (pending approval for Fall 2016)

Admissions Information

Admission decisions are based upon a thorough review of the applicant's academic record, scores on the Graduate Record Exam (please see program website for waiver/requirement information), 3 letters of recommendation, resume/CV, and a 500 word targeted essay. Other factors, such as other graduate degrees and work experience, may be considered.

Please visit the Admissions page for complete information:
http://ischool.umd.edu/content/admission

Application Deadlines

Application Requirements

1. Official transcripts for all undergraduate and graduate coursework
2. GRE General (see the MLS Admissions page for information GRE waiver requirements)
3. Three Letters of Recommendation
4. 500 word targeted essay
5. Resume/CV
6. Work history
7. International applicants must submit TOEFL or IELTS scores

Degree Requirements

Master of Library Science (M.L.S.)

The fully American Library Association (ALA) accredited Master of Library Science (MLS) program at the University of Maryland is a professional degree that provides students with a comprehensive foundation in both research and practice in library and information science. This foundation prepares students for careers in government, archives, museums, libraries, startups, and any organization engaged in information activities.

At the iSchool we seek students who will serve as the next generation of leaders in information science and who will succeed in the dynamic and evolving global information society.

The MLS program is designed for students from a wide variety of academic and career backgrounds, and is flexible enough to accommodate students working full or part-time. Students can complete their MLS degree in-person, fully online, or through a hybrid approach.

Marciano, Richard
Oard, Douglas William

Associate Professor
Elmqvist, Niklas
Golbeck, Jen
Jaeger, Paul T.
Kraus, Kari Michaele
Lin, Jimmy
Wang, Ping

Assistant Professor
Ahn, June
Chetty, Marshini
Clegg, Tamara
Findlater, Leah
Frias-Martinez, Vanessa
Punzalan, Ricardo
Shilton, Katie
St. Jean, Beth
Subramaniam, Mega M.
Tausczik, Yla
Vitak, Jessica

Adjunct Professor
Dearstyne, Bruce W.
Freeney, Maralita
Hamiel, Michelle
Roderer, Nancy
Salvadore, Maria
Spangler, Robert
Taylor, Deborah
Wester, Paul

Visiting Professor
Kurtz, Michael
Srikantaiah, Taverekere

Lecturer
Heger, Kenneth
Lawley, Katy Newton
Massey, Sheri
Simmons, Wendy
Winter, Susan

Assistant to the Dean
Barlow, Diane L.

Professor Emeritus
Lowry, Charles B.
Soergel, Dagobert
Walston, Claude E.

Each student in the MLS Program selects one of our unique specializations. Students who pursue the "Individualized Program Plan" may create their own course plan. Specialization offerings include:

- Archives and Digital Curation
- Community Analytics and Policy
- Individualized Program Plan
- Diversity and Inclusion
- School Library
- Youth Experience (pending approval for Fall 2016)

The iSchool regularly holds online information sessions about all of the program offerings. Please visit the iSchool website to sign up to attend: http://ischool.umd.edu/content/information-sessions.

Facilities and Special Resources

The College operates five research centers: the Human-Computer Interaction Lab (HCIL), the Information Policy and Access Center (iPAC), and the Center for Advanced Study of Communities and Information (CASCI), the Cloud Computing Center (CCC), and the Digital Curation Innovation Center. iSchool faculty and doctoral students also participate in or have affiliations with the University of Maryland Institute for Advanced Computer Studies (UMIACS), the Maryland Institute for Technology in the Humanities (MITH), and the Computational Linguistics and Information Processing Laboratory (CLIP), as well as the Departments of Computer Science, English, and Sociology, the Robert H. Smith School of Business, and the College of Education.

The College also operates a student computer lab for currently enrolled students.

Faculty and students participate in cooperative research with staff of the University Libraries, the Human-Computer Interaction Laboratory, and other campus units. Students have access through cooperative arrangements and programs to the resources of Archives II, the National Agricultural Library, the Library of Congress, and other prominent research facilities.

Financial Assistance

For more information on financial aid, please visit the Financial Aid section of the College of Information Studies website.

Contact Information

For specific information on the academic programs available in the College of Information Studies, admission procedures, or financial aid, contact:

Student Services Office
4110 Hornbake Building
College Park
MD 20740
Telephone: 301-405-2038
Fax: 301-314-9145
mlsporogram@umd.edu

http://ischool.umd.edu

Courses: INST LBSC INFM

Linguistics (LING)

Abstract

Research on language has proven to be one of the most fruitful means to cast light on the nature of the human mind and general cognitive capacity and has taken on a new momentum in the last 30 years. The Maryland Linguistics program builds on these recent developments and trains students thoroughly in a research enterprise which tries to develop a detailed answer to these questions: How is a person's linguistic capacity represented in the mind, how does that representation reflect properties which are encoded genetically, how is language acquired by young children, how can language be encoded as a computational, psychological or neurological system, and how can linguistic knowledge be used to improve human language technology?

The Department of Linguistics at the University of Maryland has an internationally recognized Ph.D. program. The Department combines current theoretical research in phonology, morphology, syntax, semantics with state-of-the-art experimental research in psycholinguistics, first language acquisition, language processing, neurolinguistics, and computational linguistics. An interdisciplinary background enables students to evaluate proposals critically and make a lasting contribution to the field. Many students choose to split their major and minor areas between theoretical and experimental linguistics. Many students also choose to concurrently pursue the Certificate Program in Neuroscience and Cognitive Science.

The department has strong connections with the Maryland Language Science Center which hosts an NSF-supported interdisciplinary training program (NRT) on "Flexibility in Language Processes and Technology: Human- and Global-Scale" (see the MLSC web site for more information).

The Department encourages applications from students with an interest in the Department's areas of expertise. Students with a primary interest in Neurolinguistics and Cognitive Science may also want to consider applying to the Neuroscience and Cognitive Science (NACS) Ph.D. program. See the Cognitive Neuroscience of Language Laboratory for more details on alternative programs of study for psycholinguistics.

Students seeking a Ph.D. in other areas related to linguistics may want to consider a range of other strong programs at the University of Maryland.

- The PhD program in Second Language Acquisition, based in the School of Languages, Literatures and Cultures, has a strong cognitive science and research focus.
- Students with a focus on TESOL should consider the Curriculum and Instruction Program, based in the College of Education.
- Students with a clinical focus should also consider the Hearing and Speech Sciences Program.
- Students interested in human language technology should also consider the PhD programs in the iSchool (CLIS) or the Department of Computer Science.

Admissions Information

All students must hold a Bachelors or Masters degree (or international equivalent) prior to starting the Ph.D. program. Although the student's previous degrees may be in a field other than linguistics, it is essential that a student have some previous experience in linguistics.

Applicants should check the University's admission requirements and the department's web site for the most up-to-date information on graduate applications. Electronic submission of application materials is required. Applicants are encouraged to begin the on-line application form well before the application deadline, preferably by mid-

Faculty:

Chair
Idsardi, William

Distinguished University Professor
Lasnik, Howard

Professor
Hornstein, Norbert R.
Idsardi, William
Lidz, Jeffrey
Phillips, Colin
Pietroski, Paul M.
Polinsky, Maria
Resnik, Philip S.
Uriagereka, Juan
Weinberg, Amy S.

Associate Professor
Haquard, Valentine
Williams, Alexander

Assistant Professor
Alvares de Azevedo Lau, Ellen
Feldman, Naomi
Preminger, Omer

Assistant Research Scientist
Zukowski, Andrea

Affiliate Professor
MacSwan, Jeff

Affiliate Associate Professor
Daume, Hal

Affiliate Assistant Professor
Carpuat, Marine
Huang, Yi-Ting

Senior Lecturer
Antonisse, Margaret
Bleam, Tonia

December. Note that the January target date applies to all applicants, domestic and international.

Application Deadlines

Fall:
In order to receive fullest possible consideration for admission and financial aid, all application materials should be received by January 5. The final deadline is May 15 (**January 5 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Applications normally require:

1. Application Form & Application Fee: See the Graduate School web site. Early submission of the initial on-line application is strongly encouraged.
2. Statement of Purpose: This should provide a clear explanation of what your objectives are in pursuing an advanced degree in Linguistics, and at Maryland in particular. Mention specific interests or relevant experience where applicable. The Statement of Purpose is not a literary contest or an invitation to flatter members of the department; there is no 'recipe' for a strong Statement. The Statement of Purpose allows the Department to better understand an applicant's goals, interests, and how well the applicant will be served by the department's areas of expertise.
3. Writing Sample(s): This should preferably represent original work done in linguistics, but work in other fields showing evidence of careful analysis and independent thought is also acceptable. Writing samples should be in English.
4. Letters of Recommendation: These should come from at least three people who know your work well, and who can offer a detailed, honest assessment of your abilities and experience, and your suitability for an advanced degree in Linguistics.
5. GRE General Test: Although this test is not absolutely required for admission, all applicants who hope to receive financial aid are strongly advised to take the GRE test. A wider range of sources of financial aid are open to students who have taken the GRE test.
6. TOEFL Test (or TOEFL), for international students. See the Graduate School web site for exceptions.

Degree Requirements

Master of Arts (M.A.)
Under exceptional circumstances, students are awarded an MA degree on completion of the core coursework requirements (six courses, see PhD requirements), four further classes, and writing either an MA thesis which is defended publicly (LING 799) or two comprehensive papers in different areas of language study (LING 798). Two of the post core-level class requirements should be taken in the Department of Linguistics, with the rest being taken either in Linguistics or in other departments satisfying a secondary area of specialization and complementing the student's work. **Note that the Department of Linguistics does not normally admit students whose objective is a terminal M.A. degree.** The M.A. degree primarily serves students who withdraw from the Ph.D. program.

Doctor of Philosophy (Ph.D.)
Students pursuing the Ph.D. take at least 33 graduate-level credits of course-work, of which at least 9 credits are at the 800-level (seminars) and 6 credits correspond to the Minor area of specialization, possibly in another department. These minimum requirements are usually fulfilled by formal classes and not by independent studies, although the latter may be used to supplement a student's program of study. The student's first year is normally devoted to the "core", foundational coursework in the department's three primary research areas: (i) theoretical linguistics (syntax, semantics, phonology), (ii) psycholinguistics/neurolinguistics/language acquisition, (iii) computational linguistics. Students must take at least 6 core courses, comprising at least two 2-semester core course sequences. At least one of these core course sequences must be

in an area of theoretical linguistics. The core courses are the 600 level LING courses and LING 723, 773. The core sequences are:

1. LING 610, 611 Syntax
2. LING 620, 621 Phonology
3. LING 640, 641 Psycholinguistics
4. LING 660, 661 Semantics
5. LING 723, 773 Computational Linguistics

In addition to satisfying (part of) the 9 credit requirement for seminars, the next two years are devoted to satisfying 6 credits (beyond any core courses) in the Minor, as approved by the Graduate Director. Some students choose to pursue the Certificate in Neuroscience and Cognitive Science, which may count as the minor area.

By their fifth semester, students write a substantial paper (LING 895), under the supervision of a faculty member. This paper enables students to demonstrate a capacity for productive research and to make an original contribution to the literature, often forming the basis for the dissertation research. It is submitted to a three member examining committee, is defended publicly two weeks later, and must be approved by the committee after the defense. The student must then upload the completed 895 paper to the 895 folder in the department PDF locker, and inform the Graduate Director that this has been done.

In addition, by their seventh semester students must also write a paper in their Minor area of specialization (or some other area that is not their major area). The paper must be prepared under the supervision of a member of the faculty. Once the paper is completed to the satisfaction of the supervising faculty member, it must be uploaded to the 896 folder in the department PDF locker, and the Minor Area Paper approval form presented to the Graduate Director. [Under special circumstances, upon the written recommendation of the student's advisor and with the approval of the faculty of the department, a student may satisfy the Minor area paper requirement by instead taking a third course in the Minor area.]

LING 895 and the Minor area paper replace the "comprehensive examinations" held in some departments.

To help ensure satisfactory progress towards the degree, students are required to submit to the Graduate Director a Ph.D. Roadmap once each semester, completed in consultation with their advisor.

After satisfactory completion of the 895 paper, students are admitted to candidacy and write a proposal for a dissertation, which a faculty member agrees to supervise. Students enroll in LING 899 while working on the dissertation, and must take at least 12 credits of this course. The dissertation must make a substantial and original contribution to knowledge. The supervisor, in consultation with other committee members (selected by the student and the supervisor),

determines when there is a draft which will be defended publicly at an oral examination. The dissertation is approved by a five member examining committee. On completion of the approved dissertation, a hard copy will be submitted to the department, along with a 2nd hard copy or else an electronic version for the department web page.

Facilities and Special Resources

In addition to university and departmental library facilities, linguists at Maryland have ample office and meeting spaces. The department has outstanding resources for interdisciplinary research that bridges theoretical, experimental, and computational linguistics. The Cognitive Neuroscience of Language (CNL) Laboratory has the specific purpose of bridging the gap between theoretical/computational models of human language and the brain-level mechanisms that support language. The research in the CNL Lab combines the study of linguistics, cognitive neuroscience, language acquisition and psycholinguistics, genetic disorders and computational modeling. The CNL Lab is housed in around 5000 sf. of labs and offices and includes the following:

1. Event-Related Potentials (ERP) Lab: 128-channel Neuroscan ERP facility for recording electrical signals originating in the brain by measuring electrical activity at the scalp.
2. Magnetoencephalography (MEG) Lab: a 160-channel whole-head MEG facility that is used for non-invasive measurements of the magnetic fields associated with neuronal activity in the brain.
3. Head-mounted Eye Tracking Lab: lightweight eye-tracker suitable for use with children and adults.
4. Fixed Eye Tracking Lab: eye-tracker suitable for on-line studies of reading.
5. Center for Young Children: state-of-the-art on-campus preschool for 3-6 year olds, with testing rooms suitable for study of language acquisition.
6. Infant Language Lab: for testing infants and young children.
7. Phonetic/Speech Analysis facilities: equipment for generation, recording, manipulation and analysis of speech sounds.

In addition to the facilities available at the CNL Lab itself, Maryland linguists have taken advantage of the many additional research opportunities in closely affiliated departments and institutions, in particular at the National Institutes of Health (NIH), located in nearby Bethesda, Maryland. These include fMRI brain imaging, PET brain imaging and TMS (transcranial magnetic stimulation) at NIH, and aphasia research in collaboration with NIH researchers.
Computational Linguistics
The department also runs two computational linguistics laboratories housing state-of-the art facilities funded by the NSF and DARPA. The Computational Linguistics and Information Processing (CLIP) laboratories contain state of the art computing facilities and data resources.

Financial Assistance

Initial offers of admission and financial aid are normally made in February-April. Further offers are sometimes made at a later date, if additional funds become available. In recent years, approximately six new students have started the Ph.D. program each year.

Financial aid is available on a competitive basis. The department aims to provide all enrolled graduate students with financial aid (stipend and tuition) during their full course of study (5 years), provided that the student makes satisfactory academic progress. Graduate funding comes from a number of sources. The Department offers Graduate Assistantships (GAs) and Research Assistantships (RAs). GAs typically involve teaching

support for undergraduate linguistics courses. RA positions typically involve grant-supported research projects. The University also offers a number Fellowships to outstanding applicants, which release the student from GA or RA responsibilities for 1-2 years of study. Other sources of funding are occasionally available through the Department or University. Also, a number of students secure funding of their own from external fellowships (examples include NSF GRFP, and SSHRC, NSERC (Canada)).

Fellowships and GAs provide tuition remission and health benefits, but students are responsible for mandatory student fees each semester.

The Department, College and University also provide funds to support travel by faculty and graduate students to present papers and posters at conferences.

Contact Information

The Department's web site, Maryland Linguistics, contains a good deal of information on the program, but if you have further questions about Graduate Study in the Department, you should contact Dr. Jeffrey Lidz (jlidz@umd.edu). Alternatively, if you have a particular interest in the research of an individual faculty member, you may want to contact that person directly via email.

Dr. Jeffrey Lidz
Linguistics Dept., University of Maryland,
1401 Marie Mount Hall, College Park,
MD 20742-7505
Telephone: (301) 405-7002 (301) 405-8220
Fax: (301) 405-7104
jlidz@umd.edu

http://www.ling.umd.edu

Courses: LING

Related Programs and Campus Units

Neuroscience and Cognitive Science
Second Language Acquisition-Ph.D.
Hearing and Speech Sciences

Marine-Estuarine-Environmental Sciences (MEES)

Abstract

The specific objective of the university-wide Graduate Program in Marine-Estuarine-Environmental Sciences (MEES) is the training of qualified graduate students, working toward the M.S. or Ph.D. degree, who have research interests in fields of study that involve interactions between biological, physical and chemical systems in the marine, estuarine, freshwater or terrestrial environments. The program comprises six areas of specialization: Ecology, Environmental Chemistry, Environmental Molecular Biology and Biotechnology, Environmental Science, Fisheries Science, and Oceanography. Students work with their Advisory Committee to develop a customized course of study based on research interests and previous experience.

Admissions Information

Applications for admission in the fall semester must be filed by February 1; if financial assistance is needed, it is better to apply by December 1. Students may also be admitted for the semester starting in January, for which the deadline is September 1, with July 1 as

Faculty:

Director
Paynter, Kennedy T.

Professor
Boesch, Donald F.
Boicourt, William C.
Boynton, Walter R.
Chao, Shenn-Yu
DasSarma, Shiladitya
Dennison, William C.
Eshleman, Keith Neal
Fisher, Thomas R.
Gardner, Robert H.
Glibert, Patricia M.
Hill, Russell T.
Hood, Raleigh R.
Hoogland, John L.
Houde, Edward D.
Kemp, William M.
Kennedy, Victor S.
Malone, Thomas C.
Miller, Thomas J.

the preferred deadline for assistance and June 1 as the international applicant deadline. Applicants must submit an official application to the University of Maryland, along with official transcripts of all previous collegiate work, statement of interests and experiences, resume, three letters of recommendation, and scores on the General Test (aptitude) of the Graduate Record Examinations. It is particularly important that a student articulate clearly, in the application, a statement of goals and objectives for future work in the field. Because of the interdisciplinary and interdepartmental nature of the program, only students for whom a specific advisor is identified in advance can be admitted. Prior communication with the faculty in your choice area of specialization is highly encouraged.

Application Deadlines

Fall:
Applications must be received by February 1 (**December 1 preferred**) .
Spring:
Applications must be received by September 18 (**August 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Official transcripts for all college coursework 2. Official GRE General test scores 3. Three letters of recommendation 4. Statement and resume

Degree Requirements

Doctor of Philosophy (Ph.D.)

Course Work: The student must complete a minimum of 36 credits, with at least 24 credits of course work and 12 credits of dissertation research. Twelve credits of course work must be at the 600 level or above. Course work completed to fulfill a Master's degree can be applied against this requirement, up to a maximum of 16 credits. Required course work includes a) one seminar course (MEES 608 or equivalent) is required for each year in residence (on average); b) one approved Statistics course (600 level or higher); c) one graduate course representing significant interdisciplinary breadth, outside the student's specialization; d) one course or seminar in management, ethics or philosophy of science.

Examinations: Formal application for Advancement to Candidacy for the doctoral degree requires successful completion of both a Comprehensive Examination (written and oral components) and an oral Defense of the Dissertation Proposal. The Comprehensive Examination must be passed before the student can defend the Dissertation Proposal. An Oral Defense of the Dissertation will be conducted by the Advisory Committee and will be administered once all other degree requirements have been fulfilled.

Master of Science (M.S.)

Course Work: A minimum of 30 credits with 24 credits of course work and 6 credits of graduate research. Of the 24 course credits, 12 of them must be at the 600 level or higher; including, a) one seminar course (MEES 608 or equivalent) must be taken for each year in residence (on average); b) one approved Statistics course (400 level or higher); c) one graduate course representing significant interdisciplinary breadth, outside the student's specialization; d) one course or seminar in management, ethics or philosophy of science.

Thesis Defense: An Oral Defense of the Thesis, administered according to Graduate School regulations, will take place at the completion of the research project. This defense will be conducted by the Advisory Committee and will be administered once all other degree requirements have been fulfilled.

Morgan II, Raymond P.
Newell, Roger I.E.
Palmer, Margaret
Place, Allen R.
Robb, Frank T.
Roman, Michael R.
Sanford, Lawrence P.
Secor, David H.
Sowers, Kevin R.
Stevenson, John C.
Stoecker, Diane B.
Vasta, Gerardo R.
Zohar, Yonathan

Associate Professor
Belas, M. Robert
Castro, Mark S.
Chen, Feng
Du, Shao Jun
Gates, John Edward
Hilderbrand, Robert H.
Huq, Anwarul
Jagus, Rosemary
Koch, Evamaria
Lazur, Andrew M.
Li, Ming
Mitchelmore, Carys L.
Rowe, Christopher L.
Schreier, Harold

Assistant Professor
Ahmed, Hafiz
Bi, Hongsheng
Chung, J. Sook
Crump, Byron C.
Elmore, Andrew
Fitzpatrick, Matthew
Harris, Lora
Nelson, David M.
North, Elizabeth W.
Palinkas, Cynthia
Pancer, Zeev
Schijf, Johan
Wilberg, Michael

Research Associate Professor
Cornwell, Jeffrey C.
Engelhardt, Katharina
Heyes, Andrew
Kana, Todd M.
Murray, Laura
Tamburri, Mario
Wainger, Lisa

Research Professor
Codispoti, Louis A.
Cooper, Lee
Grebmeier, Jacqueline
Harding, Lawrence W., Jr.
King, Dennis M.

Research Assistant Professor
Coles, Victoria J.
Kilbourne, Kelly H.
O'Neil, Judith M.
Pierson, James J.
Schott, Eric

Senior Agent
Meritt, Donald W.
Stylinski, Cathlyn D.

Visiting Professor
Sellner, Kevin

Facilities and Special Resources

Students may conduct their research in the laboratories and facilities of the College Park (UMCP), Baltimore (UMB), Baltimore County (UMBC), or Eastern Shore (UMES) campuses, in one of the laboratories of the University's Center for Environmental Studies (UMCES): the Chesapeake Biological Laboratory (CBL) at Solomons, Maryland; the Horn Point Laboratory (HPL) near Cambridge, Maryland; and the Appalachian Laboratory (AL) in Frostburg, Maryland; or at the Institute of Marine and Environmental Technology (IMET) in Baltimore. CBL and HPL are located on the Chesapeake Bay. They include excellent facilities for the culture of marine and estuarine organisms. Berthed at CBL are the University's research vessels. At HPL there are extensive marshes, intertidal areas, oyster shoals, tidal creeks, and rock jetties. AL, located in the mountains of western Maryland, specializes in terrestrial and freshwater ecology. On the campuses and at IMET are specialized laboratory facilities for environmental research, including microbiology; biotechnology; water chemistry; cellular, molecular, and organismal biology; and specialized facilities for remote sensing of the environment. Extensive field sites for environmental research are available through the University's agricultural programs and through cooperation with many other organizations in the state.

Financial Assistance

University fellowships, research assistantships and traineeships, and teaching assistantships are available. In general, aid provides for full living and educational expenses. Some partial assistance may also be available. Research support from federal, state, and private sources often provides opportunities for additional student support through either research assistantships or part-time employment on research projects.

Contact Information

Dr. Kennedy T. Paynter, Jr., Director
MEES Graduate Program, 1213 HJ Patterson Hall,
University of Maryland
College Park, MD 20742
Telephone: (301) 405-6938
Fax: (301) 314-4139
mees@umd.edu

http://www.mees.umd.edu/

Courses: MEES

Related Programs and Campus Units

Biological Sciences
Entomology
Sustainable Development and Conservation Biology

Mathematical Statistics (STAT)

Abstract

The Statistics Program offers the Master of Arts and Doctor of Philosophy degrees for graduate study and research in statistics and probability. Areas of faculty research activity include high dimensional data, statistical decision and estimation theory, biostatistics, stochastic modeling, robust and nonparametric inference, semiparametric inference, categorical data analysis, theory and inference for stochastic processes, stochastic analysis, time series and spatial statistics. Students may concentrate in applied or theoretical statistics by selecting an appropriate sequence of courses and a research area

Faculty:

Director
Smith, Paul J.

Distinguished University Professor
Freidlin, Mark I.

Professor
Cerrai, Sandra

to form an individual plan of study. The Program has been designed with sufficient flexibility to accommodate the student's background and interests. The Program also offers students from other disciplines an opportunity to select a variety of statistics courses to supplement their own study.

The Program is administratively affiliated with the Department of Mathematics, which maintains the records of all students in the Mathematical Statistics Program and handles correspondence with those applying for admission. However, any application for admission must indicate clearly that the student wishes to enter the Statistics (STAT) Program.

Employment prospects for statisticians are very good. All recent M.A. and Ph.D. graduates of Maryland's Statistics Program have found jobs in academia, industry and government agencies.

Dolgopyat, Dmitry
Kagan, Abram
Kedem, Benjamin
Koralov, Leonid
Lahiri, Partha
Ren, Jian-Jian
Slud, Eric Victor

Associate Professor
Smith, Paul J.

Assistant Professor
Liao, Yuan
Saegusa, Takumi
Sun, Tingni

Professor Emerita
Yang, Grace L.

Admissions Information

In addition to the Graduate School requirements, applicants with at least a B average (3.0 on a 4.0 scale) should have completed an undergraduate program of study that included a strong emphasis on rigorous mathematics or statistics. Mathematical preparation at least through the level of advanced calculus will normally be considered sufficient demonstration of the expected mathematical background. In special cases, students may be provisionally admitted without having fulfilled the general admission requirements if they can demonstrate potential success in the Program through other criteria. The General Graduate Record Examination is required for admission, and the applicants must supply the scores. The GRE subject examination in Mathematics is recommended.

Application Deadlines

Fall:
For best consideration for financial aid (**January 15 preferred**) .
Applications must be received by May 1 (**February 1 preferred**) .
Spring:
Applications must be received by October 1 (**September 15 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General(required)
2. GRE MATH (recommended)
3. 3 Letters of Recommendation
4. Transcripts
5. TOEFL/IELTS (international graduate students only)

For more specific information please see: www.blog.umd.edu/admissionsrequirements/computernatural-sciences/mathematical-statistics/

Degree Requirements

Doctor of Philosophy (Ph.D.)
The M.A. degree is not required for admission to the Ph.D. program. A doctoral student must complete a minimum of 36 hours of formal courses (at least 27 at the 600/700 level) with an average of B or better; at least 18 of the graduate credits must be taken in Statistics. In addition, the university requires at least 12 hours of STAT 899 (Doctoral Research). The Ph.D. student must take written examinations in Probability, Mathematical Statistics, and a third exam in Applied Statistics or any field of mathematics. These examinations are given by the Mathematics Department twice a year in January and August. A student may take one or more examinations at a time. The student must pass two examinations by the end of his or her third year in the graduate program, and must pass all three by the end of the fourth year. Most full-time students pass all three

examinations by the end of the second year or middle of the third year. If successful in the written examinations, the student must pass an oral examination. Administered by the Statistics faculty, the oral examination usually takes place a year after the student passes the written examination. This examination serves as a test of the student's in-depth preparation in the area of specialization and the student's research potential. Successful completion of the oral exam indicates that the student is ready to begin writing the doctoral dissertation. In addition, the Department requires a reading competence in one foreign language for the Ph.D. The student may select one of three languages: French, German or Russian. Administered and graded by the Mathematics Department, the language examination consists of translating foreign mathematical texts into competent English. To be admitted to candidacy, the Ph.D. student must pass the written examinations and the oral examination and the language examination must be completed before the candidate's final oral examination on the dissertation.

Master of Arts (M.A.)

The M.A. degree program offers both thesis and non-thesis options; the students are encouraged to choose the latter. For the non-thesis option, a student must complete 30 credit hours with at least a B average; at least 18 of these credits must be at the graduate level (600/700 level) and at least 12 of the graduate credits must be in Statistics (STAT). The student must also pass the Mathematics Department written examinations in Probability, Mathematical Statistics and one more area, such as Applied Statistics or any field of mathematics. In order to earn the M.A. degree with the non-thesis option, the student must pass two examinations by the end of his or her third year in the graduate program, and must pass all three at the M. A. level by the end of the fourth year. A student may take one or more examinations at a time. Most full-time students pass all three examinations by the end of the second year or middle of the third year. The student must also submit a satisfactory short scholarly paper.

For the thesis option, a student must: (1) complete 24 credit hours with at least 15 at the 600/700 level (of these 15 hours, at least 12 hours must be in Statistics); (2) maintain an average grade of B or better; (3) take six hours of STAT 799 (Research) in addition to (1); (4) write a satisfactory thesis; and (5) pass a final oral examination. There is no foreign language requirement for M.A. students.

The applicants should have in mind that no financial aid is offered to M. A. students.

Facilities and Special Resources

The STAT Program cooperates closely with the Mathematics Department and the Applied Mathematics and Scientific Computation (AMSC) Program. The Program's faculty are actively involved in research in applied and theoretical areas of statistics and maintain close ties with applied scientists in several federal agencies.

The Program sponsors a weekly statistics seminar. In addition, faculty-student workshops cover topics of current statistical interest.

Computing is integrated into the applied courses, and the Program also offers a course "Computational Methods in Statistics"

By scheduling many of its applied and Master's level courses in late-afternoon time slots, the Program facilitates and invites part-time graduate study.

Financial Assistance

Graduate assistantships are awarded to Ph. D. students in the Statistics Program through the Mathematics Department. At present, the teaching load is six hours each semester, in addition to the duties of meeting with students and grading papers. There are 15 graduate students in statistics with financial support. These are mostly teaching assistantships, but there are also a few research assistantships and fellowships. From time to time advanced

students are placed into research assistantships as data analysts or statistical consultants with other campus units such as the Statistics Laboratory, run jointly by the Statistics Program and the Computer Science Center. Applications for financial aid are only processed once a year, for admission for the fall semester.

Contact Information

The educational policies of the Mathematical Statistics Program is available at: www-math.umd.edu/graduate.html?id=182 This guide describes the STAT graduate program and covers the academic and procedural requirements for earning degrees.

Graduate Admissions Mathematical Statistics Program
1107 Mathematics Building

University of Maryland
College Park
MD 20742-4015
Telephone: (301) 405-5058
Fax: (301)314-0827
statgrad@deans.umd.edu

http://www-math.umd.edu/graduate.html?id=178

Courses: STAT

Related Programs and Campus Units

Mathematics
Applied Mathematics & Statistics, and Scientific Computation

Mathematics (MATH)

Abstract

Three programs are currently closely affiliated with the Mathematics Department: the Mathematics Program (MATH), the Applied Mathematics & Statistics, and Scientific Computation Program (AMSC), and the Mathematical Statistics Program (STAT). Students applying for admission should use the appropriate symbol to indicate their program of interest. The interdisciplinary Applied Mathematics & Statistics, and Scientific Computation Program offers three concentrations, one in applied mathematics, one in scientific computation, and one in applied statistics. The Statistics Program is concerned with mathematical statistics and probability. The AMSC and STAT programs are described in detail elsewhere in this catalog.

Students can earn a Doctor of Philosophy degree in the Mathematics Program. Admission for a Master's of Arts degree only is rare and only considered on a case by case basis. The master's degree is not required for entrance to the Ph.D. program.

The Mathematics Program offers graduate programs in algebra and algebraic geometry, complex analysis, dynamical systems and chaos, geometry, harmonic analysis, mathematical logic, number theory, numerical analysis, ordinary differential equations, partial differential equations, probability, real and functional analysis, representation theory, statistics and topology.

Admissions Information

Faculty:

Chair
Wolpert, Scott A.

Associate Chair
Adams, Jeffrey D.
Levy, Doron
Smith, Paul J.
Tamvakis, Harry
Washington, Lawrence C.

Distinguished Scholar-Teacher
Benedetto, John J.
Goldman, William M.
Lay, David C.
Levy, Doron
Washington, Lawrence C.
Wolpert, Scott A.

Distinguished University Professor
Freidlin, Mark I.
Novikov, Sergey
Tadmor, Eitan

Professor
Adams, Jeffrey D.
Balan, Radu
Benedetto, John J.
Boyle, Mike M.
Brosnan, Patrick

Admission is granted to applicants who show promise in mathematics as demonstrated by their undergraduate record. Unless courses in advanced calculus and (undergraduate) abstract and linear algebra have been taken, admission may be on a provisional basis (conditioned on passing MATH 410, 403, and/or 405 with a grade of B). Both the Subject Test and the General Test of the Graduate Record Examination are required for admission. MATH rarely accepts students aiming only at the M.A. degree.

Application Deadlines

Fall:
For best consideration for financial aid (**January 15 preferred**) .
Applications for admission without financial aid must be received by May 1 (**February 1 preferred**) .
Spring:
No financial aid offered for Spring admissions. Applications must be received by October 1 (**September 15 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

GRE General, GRE Mathematics, 3 letters of recommendation, Transcripts, TOEFL/IELTS (international graduate students - required even if eligible for a waiver) For more specific information please see:www.blog.umd.edu/admissionsrequirements/computernatural-sciences/mathematics/

Degree Requirements

Doctor of Philosophy (Ph.D.)

The Ph.D. program does not require an M.A. degree, but applicants who are accepted should show, on the basis of their undergraduate record and recommendations, that they possess not only marked promise in mathematical activities but the potential to perform on a creative level. Like the M.A. program, admission may be granted on a provisional basis.

Students in the Ph.D. program must complete a minimum of 36 hours of formal coursework (at least 27 at the 600/700 level) with an average grade of B or better; at least 18 hours must be taken in the Department of Mathematics. In addition, the university requires at least 12 hours of MATH 899 (Doctoral Research). Ph.D. students must pass two qualifying exams, and in addition must take and pass four semesters of courses from a specific list with a grade of B or better, and an overall grade point average of at least 3.3 in these four courses (these courses constitute the third and final qualifying exam requirement). These four courses must be distinct from the ones supporting the qualifying exams. The purpose of the written qualifying exams is to indicate that the student has the basic knowledge and mathematical ability to begin advanced study. Passing the exams is thus supposed to certify understanding of (selected) first-year graduate material. These examinations are given twice a year, in January and August. A student may take one or more examinations at a time. All three examinations/qual course requirements must be passed by January of the student's third year in the graduate program. If successful in these written examinations, students must do advanced reading and coursework in their special area of interest before they can be admitted to candidacy and begin dissertation research. The dissertation must represent an original contribution to mathematical knowledge and is usually published in a mathematical journal.

Generally Ph.D. students spend five or six years before obtaining the degree. The combined programs of mathematics, applied mathematics and statistics award an average of 18 Ph.D.s each year. The Ph.D. program has a foreign language requirement. Before a student can schedule the Final Oral Examination, he or she must pass a written examination in either French, German or Russian. The language examinations are composed and graded within the Department and involve translating a passage from a mathematical text into competent English.

Cerrai, Sandra
Cohen, Joel M.
Czaja, Wojciech
Dolgopyat, Dmitry
Fitzpatrick, Patrick M.
Forni, Giovanni
Freidlin, Mark I.
Glaz, Harland M.
Goldman, William M.
Grillakis, Manoussos
Gulick, Denny
Haines, Thomas J.
Halperin, Stephen
Hamilton, David H.
He, Xuhua
Jabin, Pierre-Emmanuel
Jakobson, Michael
Kagan, Abram
Kaloshin, Vadim
Kedem, Benjamin
Koralov, Leonid
Laskowski, Michael C.
Levermore, Charles D.
Levy, Doron
Machedon, Matei
Margetis, Dionisios
Mellet, Antoine
Millson, John J.
Nochetto, Ricardo H.
Novikov, Sergey
Okoudjou, Kasso A.
Ren, Jian-Jian
Rosenberg, Jonathan M.
Schafer, James A.
Slud, Eric Victor
Tadmor, Eitan
Tamvakis, Harry
Trivisa, Konstantina
Washington, Lawrence C.
Wentworth, Richard A.
Wolpert, Scott A.

Associate Professor
Melnick, Karin
Ramachandran, Niranjan
Rubinstein, Yanir A.
Smith, Paul J.
Winkelnkemper, Horst E.
von Petersdorff, Tobias

Assistant Professor
Bedrossian, Jacob
Cameron, Maria
Gholampour, Amin
Hein, Hans Joachim
Liao, Yuan
Saegusa, Takumi
Sun, Tingni
Zickert, Christian

Affiliate Professor
Elman, Howard C.
Gasarch, William
Gates, Sylvester James, Jr.

Distinguished University Professor Emeritus
Antman, Stuart S.
Babuska, Ivo M.
Yorke, James A.

Professor Emerita
Ehrlich, Gertrude
Herb, Rebecca A.

Master of Arts (M.A.)
The M.A. degree is usually obtained on the way to a Ph.D. degree. The M.A. degree program offers both a thesis and non-thesis option; most students choose the latter. The non-thesis option requires students to take 30 credit hours with an average of at least a B. At least 18 credits must be at the 600/700 level, including at least 12 hours in mathematics. Additionally, students must complete two full-year sequences at the 600/700 level. In addition students must receive at least an M.A. pass on two Ph.D. written exams and must take three additional semesters of courses from a specific list. These three courses must be distinct from the ones supporting the qualifying exams; and write a scholarly paper.

The thesis option requires a total of 24 hours of courses carrying graduate credit of which at least 15 are at the 600/700 level. Of these 15 hours at least 12 must be in mathematics. Of these 12 hours, at least 3 hours must be in each of two fields of mathematics distinct from the one in which the thesis is written, and must be passed with a grade of B or better. The student must also take 6 hours of thesis research, write a satisfactory thesis, and pass a final oral examination.

The M.A. degree includes no foreign language requirement. Generally it takes two to three years to earn the M.A., and approximately 20 degrees are granted each year in mathematics (MATH, STAT, and AMSC combined).

The department also has a 5-year program to earn a combined M.A./B.S. degree. The requirements for this program include the requirements for both the B.S. degree and the M.A. degree, with 9 hours of overlapping credits. Either the thesis or non-thesis option for the M.A. degree is available in this program.

Facilities and Special Resources

The Department is actively involved in research in a number of areas, strengthened further by a complement of mathematicians from the Institute for Physical Science and Technology. The Department fosters a lively program of seminars and colloquia; about half of these talks are given by outside specialists. In addition the department has a tradition of hosting distinguished long term visitors who give series of seminar talks or teach semester long courses.

The Engineering and Physical Sciences Library is located on the ground floor of the Mathematics Building and contains more than 95,000 volumes in mathematics, physics and engineering, and more than 280 journals in pure and applied mathematics. The Library of Congress, with its extensive collection of books and technical reports, is only a half hour from campus.

The Department has a large network of computers mostly running Linux. The Department houses a computer classroom and a Mathematical Visualization Lab, and similar labs are scattered across campus. There are computers in almost all graduate student offices, and many of the other computers on campus are available for student use.

The Department cooperates closely with the Institute for Physical Science and Technology and with the Department of Computer Science. Faculty members of both groups offer courses in the Department. Computer facilities are available to serve the research needs of both faculty and graduate students. Members of the Department participate actively in the interdisciplinary AMSC Program, and they also staff the Mathematical Statistics Program.

Financial Assistance

The MATH program is expecting to support about 12 new doctoral students each Fall. Offers of support are generally made for up to five years, contingent on the student making satisfactory academic progress. Except for unusual circumstances, offers of financial aid will not be made to applicants seeking a Master's degree. The normal

Lehner, Ellen Correl
Yang, Grace L.

Professor Emeritus
Adams, William W.
Alexander, James C.
Auslander, Joseph
Berenstein, Carlos A.
Brin, Michael I.
Cooper, Jeffery M.
Ellis, Robert L.
Fey, James T.
Goldhaber, Jacob K.
Green, Paul S.
Grove, Karsten
Heins, Maurice H.
Hunt, Brian R.
Johnson, Raymond L.
King, Henry C.
Kirwan, William E.
Kleppner, Adam
Kueker, David W.
Lay, David C.
Lipsman, Ronald L.
Markley, Nelson G.
Neri, Umberto
Owings Jr., James C.
Schneider, David I.
Wolfe, Peter

Associate Professor Emeritus
Berg, Kenneth R.
Dancis, Jerome
Helzer, Garry A.
Sather, Jerome O.
Schneider, David I.
Warner, C. Robert

teaching load is four to six hours per week of classroom teaching in addition to the duties of meeting with students and grading papers. Sometimes fellowships and research assistantships are also available.

Contact Information

More information about the Mathematics Graduate Program is available at www-math.umd.edu/graduate/, and information about admissions is available at www-math.umd.edu/graduate/prospective-students.html/.

For questions regarding Departmental programs, admission procedures, and financial aid, contact:

Graduate Office
1112 Mathematics Building
University of Maryland
College Park, MD 20740
Telephone: (301) 405-5061
Fax: (301) 314-0827
mathgrad@deans.umd.edu

http://www-math.umd.edu/graduate.html

Courses: MATH

Related Programs and Campus Units

Engineering: Systems Engineering
Applied Mathematics & Statistics, and Scientific Computation
Mathematical Statistics

Mathematics of Advanced Industrial Technology (MAIT)

Faculty:

Director
Benedetto, John J.

Professor
Healy, Dennis M.

University Affiliate
Easley, Glenn R.
Kolesar, Joseph D.

Abstract

The Norbert Wiener Center, a research and educational unit in the Department of Mathematics at the University of Maryland, College Park, offers a professional Masters degree focusing on the modern mathematical methods and algorithms that underlie today's cutting-edge engineering: The Mathematics of Advanced Industrial Technology (MAIT).

Our program is designed for individuals working in mathematical engineering who are looking for a fast track to understanding and applying the most up-to-date ideas in their current and future projects. Undergraduate degree holders can advance to the Masters level, and Masters degree holders can advance their applicable skills.

In addition to the professional Masters degree, we also offer two certificate programs. For students wishing to enhance their career skills in specific subject matter, the Center also offers a Graduate Certificate in Mathematics of Advanced Industrial Technology to students completing 4 courses (12 credits) within the program. The Norbert Wiener Center also offers a specific Graduate Certificate concentration in Computational Harmonic Analysis. This 12-credit program is tailored to working engineers and scientists wishing to advance their understanding of the latest Fourier, Wavelet, and Time-Frequency Harmonic Analysis methods and algorithms.

Fields including RF and Optical Communications, Signal and Image Processing, Sensor Networks, RADAR and SONAR, Navigations and Avionics, Medical Imaging and Diagnostics, Control Systems, and Robotics, increasingly rely on fast, embedded mathematical algorithms executing on the latest microprocessors, micro-controllers, and DSP cores. Budding fields such as Bioinformatics, Nanotechnology, Data Mining, and Quantum Computing are likewise being built from the ground up around modern mathematical methods. Engineers and scientists that understand advanced mathematical toolsets will have the edge in creating tomorrow's technologies.

The Norbert Wiener Center's educational mission is to teach the mathematics of modern engineering in an accessible and applicable manner. Our faculty is drawn from both academia and industry in order to balance theoretical and "hands on" approaches in the most constructive way. Our courses offer the latest information while tying modern theory directly to application by incorporating industry standard tools. Graduates of the Norbert Wiener Center will be well equipped to apply the latest mathematical tools to advance both their projects and their careers.

The most up-to-date information about the MAIT program can be found on our website at www.mait.umd.edu

Admissions Information

THIS PROGRAM IS NOT ACCEPTING NEW STUDENTS AT THIS TIME.

Students entering the program should hold a regionally accredited baccalaureate degree in Mathematics, Engineering, Physics, or a related technical field. Mathematical background should include Calculus, Differential Equations, and Linear Algebra, as well as experience and/or coursework in one or more of the following areas: Scientific Computing, Digital Signal Processing, Numerical Analysis, Boundary Value Problems, Fourier methods, Complex Variables. MAIT also offers preadmission classes to help interested students fulfill these requirements.

Application Deadlines

Fall:
Applications must be received by August 15 .

Application Requirements

THIS PROGRAM IS NOT ACCEPTING NEW STUDENTS AT THIS TIME

Students entering the program should hold a regionally accredited baccalaureate degree in Mathematics, Engineering, Physics, or a related technical field. Mathematical background should include Calculus, Differential Equations, and Linear Algebra, as well as experience and/or coursework in one or more of the following areas: Scientific Computing, Digital Signal Processing, Numerical Analysis, Boundary Value Problems, Fourier methods, Complex Variables. MAIT also offers preadmission classes to help interested students fulfill these requirements.

Degree Requirements

Certificate in Computational Harmonic Analysis (Certificate)
The Norbert Wiener Center offers a specific Graduate Certificate concentration in Computational Harmonic Analysis. This 12-credit program is tailored to working engineers and scientists wishing to advance their understanding of the latest Fourier, Wavelet, and Time-Frequency Harmonic Analysis methods and algorithms. The program will include the following courses: MAIT 633 Applied Fourier Analysis; MAIT 623-624 Modern Mathematical Methods of Signal and Image Processing; and a fourth elective

selected with the approval of the student's advisor. Coursework must be completed with a GPA of 3.0 or higher.

Master of Mathematics of Advanced Industrial Technology (MS)
The Master of Mathematics of Advanced Industrial Technology (MAIT) degree requires 10 classes (30 credits) to be completed with a GPA of 3.0 or higher. Coursework must include 3 core subjects (MAIT 613 Advanced Applied Linear Algebra, MAIT 623 Modern Mathematical Methods of Signal and Image Processing I, and MAIT 633 Applied Fourier Analysis), as well as electives chosen from a host of options. Coursework also must include a one or two-semester practical project course under the guidance of a faculty member. The project course may be employer-work related. The student's faculty advisor must approve program coursework.

Certificate in Mathematics of Advanced Industrial Technology (Certificate)
For students wishing to enhance their career skills in specific subject matter, the Center also offers a Graduate Certificate in Mathematics of Advanced Industrial Technology to students completing 4 courses (12 credits) within the program. Coursework will include at least 2 of the core subjects and 2 listed electives to be completed with a GPA of 3.0 or higher.

Facilities and Special Resources

Courses for the MAIT program will be taught in the evening at the College Park Campus and also at sites in northern Virginia. The MAIT program is administered by the Norbert Wiener Center for Harmonic Analysis and Applications which is located within the Mathematics department on the second floor of the Mathematics building on Campus Drive in College Park.

Financial Assistance

Contact Information

Additional information can be found on the MAIT web site at www.mait.umd.edu A brochure describing the program is available from the program office or from the web site in electronic form (*.pdf).

Program Coordinator
Suite 2211, Department of Mathematics, University of Maryland, College Park
MD 20740
Telephone: (301) 405-5158
Fax: (301) 314-6710
mait@math.umd.edu

http://www.norbertwiener.umd.edu/Education/MAIT.html

Courses:

Multimedia Journalism (Z071)

Faculty:

Abstract

The Graduate Certificate of Professional Studies in Multimedia Journalism teaches the skills most in demand today for communication professionals in news organizations, nonprofits, and business. Multimedia Journalism blends practical training in video, audio, photography, blogging, and interactive Web publishing with the critical application of editorial, ethical and legal principles in digital media contexts.

Multimedia Journalism is designed for professional journalists and communicators to

learn the skills and concepts needed for digital storytelling across media platforms, particularly the Internet and mobile devices. The program offers updated skills to professionals in a field – news and communication – where technology and software are changing so rapidly that it is hard for anyone to stay current. Topics include Multimedia Journalism, Online Journalism, Mobile Journalism, and New Media Entrepreneurship.

Multimedia Journalism is a 12-credit graduate certificate that targets working professionals. Classes meet in the fall and spring semesters and are timed to meet professional work schedules. Completion of all four courses provides media professionals with a thorough understanding of digital communication and entrepreneurship, including the fundamentals of Web publishing, social networking and online community building.

Admissions Information

Please visit the following link to review Admission Requirements:
http://oes.umd.edu/professional-programs/journalism/jour-application-information

UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS). For additional requirements, please see: http://oes.umd.edu/professional-programs/journalism/jour-application-information#international

Application Deadlines

Application Requirements

All application materials must be received by the deadlines below. Fall semester: by July 31st (5pm EST) Spring Semester: by December 1

Degree Requirements

Multimedia Journalism (GCPS)

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/journalism

Courses:

Music (MUSC)

Faculty:

Director
Gibson, Robert L.

Abstract

The UM School of Music offers programs of study leading to the Master of Music degree with areas of specialization in performance, composition, conducting, and music education; the Master of Arts degree with areas in ethnomusicology, music history and

literature (musicology), music education, and music theory; the Doctor of Philosophy degree with areas of specialization in ethnomusicology, musicology, music theory, and music education; and the Doctor of Musical Arts degree with areas of specialization in composition, performance, and conducting.

Admissions Information

Admission to graduate degree programs in music is highly selective. It is determined primarily by a performance audition, tapes and scores of original compositions, scholarly research papers, letters of recommendation, and/or successful teaching experience; additionally, in some academic areas, the general GRE scores are considered. All non-native English-speaking students (including students with prior United States degrees) must achieve a score of 100 on the TOEFL to be invited for audition/admission.

Application Deadlines

Fall:
Applications must be received by December 1 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General for Ethnomusicology, Historical Musicology and Music Theory
2. 3 Letters of Recommendation
3. Audition/Interview
4. Repertoire/List of Performances
5. Research paper for Ethnomusicology and Historical Musicology
6. Two scholarly papers or thesis chapters for Music Theory
7. Scores for Composition
8. Pre-screen recordings for flute, collaborative piano, conducting, trumpet and vocal applicants. Please see our website, www.music.umd.edu, for further information.
9. All non-native English-speaking students (including students with prior United States degrees) must achieve a score of 100 on the TOEFL to be invited for audition/admission.

Degree Requirements

Doctor of Philosophy or Doctor of Musical Arts (Ph.D.; D.M.A.; Ed.D.)

The Doctor of Philosophy and the Doctor of Musical Arts degrees require the satisfactory completion of a significant body of coursework that, in the student's and Graduate Advisor's judgement, prepares the student for the preliminary examination that leads to admission to candidacy, as well as certain specific courses required in each area of specialization. A dissertation (whether written, or in project form) is required for all doctoral degrees in music. A Principal Advisor for the dissertation will be chosen by the student and the academic advisor; the Principal Advisor and the student will then nominate the remaining members of the dissertation committee. The student must submit a detailed Prospectus of the dissertation to the members of the dissertation committee and the Graduate Director, and must be admitted to candidacy prior to the approval of the dissertation committee by the Graduate School. The dissertation must be successfully defended before the entire dissertation committee. The Doctor of Philosophy degree requires a Written Dissertation; the Doctor of Musical Arts degree requires a Written Dissertation, a Recording Project, a Performance Project, or a Musical Composition.

Master of Music or Master of Arts (M.M.; M.A.)

The Master of Music Degree (Non-Thesis Option in Composition, Conducting, Music Education, or Performance) requires a minimum of between 31 and 36 credit hours depending on the specific program. Required coursework is distributed among three areas of study: Major studies, Studies in Areas Supporting the Major, and Other Studies in Music. In addition, a grade of B- or better is required in all courses used to fulfill requirements for the degree; a scholarly research paper must be written as part of MUSC

Associate Director
Warfield, Patrick

Professor
Balthrop, Carmen A.
Cossa, Dominic F.
DeLio, Thomas J.
Dedova, Larissa
Gibson, Robert L.
Haggh, Barbara H.
Hill, Mark D.
Mabbs, Linda
Maclary, Edward
Montgomery, William L.
Page, Cleveland L.
Salness, David
Sloan, Rita
Vadala, Christopher J.
Votta, Michael
Wexler, Richard
Witzleben, J. Lawrence
Ziegler, Delores

Associate Professor
DiLutis, Robert
Fry, James H.
Gekker, Paul C.
Gowen, Bradford P.
Haldey, Olga
Hanninen, Dora A.
Hewitt, Michael P.
King, Richard G.
Miller, Gregory
Murdock, Katherine
Ross, James
Sparks, L. Richmond
Stern, James
Tsong, Mayron
Warfield, Patrick
Wilson, Gran
Wilson, Mark E.

Assistant Professor
Elpus, Kenneth
Kier, Craig
Kutz, Eric
Muresanu, Irina
Prichard, Stephanie
Rios, Fernando

Professor of Practice
Montgomery, Janet

Lecturer
Alvi, Diba
Ames, F. Anthony
Arsenault, Leah
Baldwin, Tom
Barber, Richard
Cigan, Paul
Fedderly, David
Foster, Daniel
Froom, David
Fuller, Sarah
Gilliam, Jauvon
Goldman, Aaron
Goldman, Dianne
Guilford, Matthew
Hearn, Barry
Heckscher, Erich
Heineman, Sue
Hendrickson, Steve
Hinkle, Lee
Jones, David W.
Kellner, P. Steve

648 Seminar in Music Research or MUED 690 Research Methods; a Final Project must be completed satisfactorily; and an oral comprehensive examination of courses required in Major Studies and in Studies in Areas Supportive of the Major must be passed. Specific courses are required in each area of specialization.

The Master of Arts Degree (Thesis Option in Ethnomusicology, Music Education, Music History and Literature [Musicology], or Music Theory; Non-Thesis Option in Ethnomusicology or Music History and Literature [Musicology]) requires a minimum of 30 credit hours (35 for Ethnomusicology), with a minimum of 12 credit hours in Major Studies, 9 credit hours in Studies in Areas Supportive of the Major (14 for Ethnomusicology), and 9 credit hours in Other Studies in Music. In addition, a grade of B- or better is required in all courses used to fulfill requirements for the degree; a Thesis must be written (Ethnomusicology Non-Thesis Option requires two scholarly research papers), an oral defense of the Thesis (or research papers) must be passed; and a written comprehensive examination must be passed. Specific courses are required in each area of specialization.

Facilities and Special Resources

In the past decade, the University of Maryland has emerged as one of the nation's leading public universities. The School of Music's home, the Clarice Smith Performing Arts Center, is the largest venue of its kind in the U.S. This $130 million facility offers six performance halls, a performing arts library, specialized rehearsal rooms, classrooms and more. The faculty here are exceptional as well, including nationally and internationally recognized artists and scholars. We recently welcomed the Orpheus Chamber Orchestra, composer Mortin Subotnick, and composer Domenik Argento as artists in residence. More than a dozen members of the National Symphony Orchestra are current UMD faculty. Plus, our location and reputation continue to draw leading educators, performers, and researchers from the field. Of course, our students themselves are a huge asset! Our diverse student body comprises some of the most talented and dynamic individuals on campus. Music majors constitute one of the strongest communities at UMD, contributing greatly to the campus's cultural life. With approximately 300 public performances each year - showcasing student recitalists and more than 30 ensembles - our students keep a high profile.

The Performing Arts Library in the Clarice Smith Performing Arts Center ranks among the top twenty university music libraries in the United States, and it offers a variety of archives, special collections, and other research resources that give it international stature among scholars in a broad spectrum of music disciplines. The total music collection includes approximately 50,000 books, 150,000 scores, 140,000 recordings, and 4,500 linear feet of archival materials.

The International Piano Archives at Maryland (IPAM) is the only institutional collection in existence devoted to historic piano performance. IPAM contains 40,000 recordings, 8,500 music scores, 2,500 books, and a collection of reproducing pianos with 8,000 piano rolls. To date IPAM has acquired the collections of more than 40 eminent pianists. The Special Collections in Performing Arts embrace a growing number of national and international music organization archives representing music education, band history, solo and ensemble instrumental performance, music librarianship, and ethnomusicology. Materials in these archives include papers, music scores, recordings, books, magazines, photographs, and oral histories. The library also features important archival and manuscript collections on music criticism and American music, the Charles Fowler Papers supporting the study of arts education, a significant Leopold Stokowski Collection, the Jacob Coopersmith Collection of Handeliana, the Radio Station WOR/Alfred Wallen stein Collection of 26,000 orchestral scores, and the performance parts of the Andre Kostelanetz Orchestra.

Within a few miles of the College Park campus are research opportunities offered by Dumbarton Oaks, the Enoch Pratt Free Library of Baltimore, the Folger Shakespeare Library, the Library of Congress, the National Archives, the Smithsonian Institution, and many other specialized libraries.

Kunkel, Gerald
Layton, Richard D.
Lee, Justina
Manzo, Anthony
McReynolds, R. Timothy
Mulcahy, Craig
Munds, Phil
Oppelt, Robert J.
Osterloh, Elijah
Ozment, Jon
Patterson, Benjamin
Powell, Tim
Randall, Martha Lee
Redd, Chuck
Shin, Eric
Slowik, Kenneth
Stewart, Catherine
Teie, David E.
Tochka, Nicholas
Trahan, Kathleen
Volchok, Mikhail
Zimmerman, Daniel J.

University Affiliate
Evans, William C.
Okamoto, Kyoko
Olcott, Nicholas
Suadin, I Ketut
Wang, Sebastian

Professor Emerita
Elsing, Evelyn L.

Professor Emeritus
Cohen, H. Robert
Fischbach, Gerald F.
Major, Leon
Moss, Lawrence K.
Pacholczyk, Jozef M.
Provine, Robert C.

Associate Professor Emeritus
Loup, Francois
Wakefield, John E.

The musical environment of the entire Washington-Baltimore area is unusually varied and rich with performances at the John F. Kennedy Center for the Performing Arts, Constitution Hall, the National Gallery of Art, the Phillips Collection, the Library of Congress, Wolf Trap Farm Park, the Smithsonian Institution, the Corcoran Gallery of Art, and the Joseph Meyerhoff Symphony Hall in Baltimore.

Financial Assistance

A number of competitive fellowships, graduate assistantships, teaching assistantships, operatic assistantships, and orchestral assistantships are available. Preference for financial assistance will be given to those who have filed an application for admission to the University and the School of Music Supplemental Application by December 1 (for performance programs) and January 15 (for Music Education only) and have been officially admitted.

Contact Information

School of Music: Graduate Programs handbook (available online at:http://www.music.umd.edu/current_students/handbooks) provides descriptive information, details of course requirements, examination procedures, and graduation requirements for the M. A., M. M., D. M. A., and Ph. D. degree programs. International students should read the information contained in the International Applicants section of the Graduate Admission Application. Specific information may also be obtained from:

Craig Arnold, Assistant Director for Student Services or
Ms. Jenny Lang, Assistant Director for Admissions, or
Mr. David Powell, Admissions Coordinator
2110 Clarice Smith Performing Arts Center
College Park
MD 20742
Telephone: (301) 405-8435
Fax: (301) 314-7966
musicadmissions@umd.edu

http://www.music.umd.edu

Courses: MUSC MUSP MUED

Neuroscience and Cognitive Science (NACS)

Abstract

The NACS program offers a wide range of research and training opportunities for students who are interested in pursuing doctoral-level research in a variety of areas within neuroscience and cognitive science. Faculty research interests center around seven main areas: Cellular & Molecular, Sensory & Motor Systems, Computational Modeling & Theory, Language & Speech, Cognition & Emotion, Development & Aging, and Disorders & Treatment. Research approaches include both the theoretical and experimental, with several laboratories doing both. Research and training activities of NACS take place within the laboratories of faculty in 23 participating departments and units: Aerospace Engineering, Animal and Avian Sciences, Behavioral and Community Health, Bioengineering, Biology, Computer Science, Electrical and Computer Engineering, English, Entomology, Epidemiology & Biostatistics, Hearing and Speech Sciences, Human Development, Kinesiology, Linguistics, Nutrition and Food Science, Philosophy, Psychology, and Teaching and Learning, Policy and Leadership, as well as the Center for Advanced Study of Language, the Institute for Advanced Computer Studies, the Institute for Systems Research, the Maryland Neuroimaging Center, and the Second Language Acquisition program. The NACS program requires the completion of two required core courses and three out of five core courses, including introduction to neurosciences, cognitive neuroscience, computational neuroscience, cellular and

Faculty:

Professor
Aloimonos, John
Ball, Gregory
Borgia, Gerald
Brauth, Steven E.
Carr, Catherine E.
Carruthers, Peter
Cassidy, Jude Anne
Castonguay, Thomas W.
Clark, Jane E.
Cohen, Avis H.
Dooling, Robert J.
Dunbar, Kevin
Fox, Nathan A.
Gordon-Salant, Sandra
Hatfield, Bradley D.
Hornstein, Norbert R.
Idsardi, William
Killen, Melanie A.
Krishnaprasad, P.S.
Lasnik, Howard
Lejuez, Carl W.
Levine, William S.
Lidz, Jeffrey
MacSwan, Jeff

molecular neuroscience, and cognitive science. The goal of the Program is to bring together the diverse perspectives and strengths of all the included disciplines in order to understand the working of the nervous system, the mind, and behavior. For more information, please visit our web site: http://www.nacs.umd.edu.

Admissions Information

Admission to the NACS Program requires a bachelor's degree from a recognized undergraduate institution. Course work in calculus is strongly recommended, as is some background in neuroscience, computational science, or cognitive science. The Program requires the Graduate Record Examination scores; transcripts; statement of goals, research interests, and experiences; and three letters of recommendation.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
Spring applications accepted only for UM Transfer Graduate Students. Applications must be received by September 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. Statement of goals, research interests, and experiences
3. Transcripts
4. 3 Letters of Recommendation

Degree Requirements

Doctor of Philosophy (Ph.D.)

The NACS Program emphasizes research training and thus requires only 25 credits of course work over the first four years. Specific requirements include two core courses--a scientific ethics course and a foundational readings course--and three out of five core courses from among introduction to neuroscience, cognitive neuroscience, computational neuroscience, cellular and molecular neuroscience, and cognitive science. Students engage in a Research Project in their first year that culminates in a written report and oral presentation. A qualifying examination is given at the beginning of the third year to ensure that all students have a core knowledge of basic neuroscience and cognitive science, and that each student has the knowledge and skills necessary to develop a dissertation proposal. By the end of their fourth year, students formally present their dissertation proposal and are admitted to candidacy. The dissertation is normally completed within one year of the proposal defense.

Facilities and Special Resources

The Program, by virtue of its breadth, has access to the facilities of all the departments, institutes, and centers of its faculty members. These include the Institute for Systems Research, the Institute for Advanced Computer Studies, the Center for Advanced Study of Language, the Maryland Neuroimaging Center, and the various well-equipped research laboratories and department facilities of the faculty. Animal facilities are available where necessary. NACS has developed close collaborations with the National Institutes of Health (NIH), Children's National Medical Center (CNMC), and Walter Reed National Military Medical Center (WRNMMC). NACS students can conduct research in laboratories with NACS adjunct faculty at these institutions. Thus, these relationships extend research and training opportunities for students while they get their degrees from the NACS program.

Newcomb, Robert W.
Payne, Richard
Perlis, Donald R.
Pessoa, Luiz
Phillips, Colin
Popper, Arthur N.
Porter, Tom E.
Ratner, Nan Bernstein
Reggia, James A.
Resnik, Philip S.
Rey, Georges
Shamma, Shihab
Simon, Jonathan
Uriagereka, Juan
Wallsten, Thomas S
Weinberg, Amy S.
Yeni-Komshian, Grace H.

Associate Professor
Abshire, Pamela
Aranda-Espinoza, Jose Helim
Coleman, Linda K.
Dorr, Bonnie J.
Dougherty, Michael
Herberholz, Jens
Horiuchi, Timothy
Israel, Michael
Jacobs, David
Jiang, Nan
Newman, Rochelle
Norman, Kent L.
Quinlan, Elizabeth
Roth, Stephen M.
Shim, Jae Kun
Smith, J. Carson
Stricklin, William R.
Taneyhill, Lisa
Wang, Jian
Yager, David D.

Assistant Professor
Anderson, Samira
Araneda, Ricardo
Beier, Jonathan
Bernat, Edward
Bolger, Donald J.
Butler, Lucas
Butts, Daniel
Carleton, Karen
Chen, Shuo
Dougherty, Lea
Feldman, Naomi
Gaudry, Quentin
Glasper Andrews, Erica
Goupell, Matthew
Hacquard, Valentine
Huang, Yi-Ting
Kanold, Patrick
Lau, Ellen
Miller, Ross H.
Novick, Jared
Paley, Derek
Prather, Richard
Redcay, Elizabeth
Riggins, Tracy
Roesch, Matthew
Shackman, Alexander
Shah, Yasmeen
Singer, Joshua
Slevc, Robert

Distinguished University Professor Emeritus
Hodos, William

Financial Assistance

Fellowships are available on a competitive basis to both entering and continuing students, while qualified students may also receive teaching assistantships. In addition, some faculty have research assistantships for their students.

Contact Information

Program Director - Jens Herberholz
2123H Biology/Psychology Building, College Park
MD 20742
Telephone: (301) 405-5902
jherberh@umd.edu

Admissions Director - Matthew Roesch
2123G Biology-Psychology Building, College Park
MD 20742
Telephone: 301-405-2274
mroesch@umd.edu

Graduate Director - Richard Payne
3220 Biology-Psychology Building, College Park
MD 20742
Telephone: 301-405-1094
rpayne@umd.edu

Assistant Director - Pam Komarek
2131 Biology-Psychology Building, College Park
MD 20742
Telephone: 301-405-8910
pkomarek@umd.edu

http://www.nacs.umd.edu

Courses: NACS

Related Programs and Campus Units

Kinesiology
Animal Sciences

Linguistics
Hearing and Speech Sciences
Clinical Audiology
Psychology
Engineering: Electrical & Computer Engineering
Engineering: Bioengineering
Computer Science
Education: Human Development
Biological Sciences
Nutrition and Food Science

Nutrition and Food Science (NFSC)

Faculty:

Acting Chair
Jackson, Robert T.

The Department of Nutrition and Food Science offers courses that may involve the use of animals. Students who are concerned about the use of animals in teaching have the responsibility to contact the instructor, prior to course enrollment, to determine whether

animals will be used in the course, whether class exercises involving animals are optional or required, and what alternatives, if any, are available.

Abstract

The Graduate Program in Nutrition and Food Science is an interdisciplinary and interdepartmental program administered by the Department of Nutrition and Food Science (NFSC). The program draws upon faculty and scientists from numerous schools, departments, and organizations. These include the Departments of Animal and Avian Sciences, Anthropology, Cell Biology and Molecular Genetics, Chemistry and Biochemistry, Nutrition and Food Science, and Plant Science and Landscape Architecture; the School of Public Health; and nearby research institutions. The Director of the Graduate Program in Nutrition and Food Science is selected from amongst faculty to administer the program.

The program offers graduate study leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees in Nutrition and Food Science with specialization in either Nutrition or Food Science. All programs require completion of a research project (thesis or dissertation). Programs of research are individually planned with the student, an advisor and an appropriate Graduate Advisory Committee. Research interests of faculty members specializing in Nutrition include the genetic and metabolic basis for dietary requirements of animals and humans, nutritional biochemistry, nutritional aspects of chronic disease, international nutrition, community nutrition, epidemiology, neuroscience, health behavior and health promotion. Research interests of faculty members specializing in Food Science include food chemistry, food processing and engineering, food microbiology, food safety, food nanotechnology, food toxicology, public policy, risk assessment and functional and nutraceutical foods.

Admissions Information

The Graduate Program in Nutrition and Food Science Admissions Committee reviews all applications and makes recommendations based on the applicant's total record. Acceptance to the graduate program is based upon academic transcripts, three letters of recommendation, a 300-500 word statement of career objectives and professional experience (statement of purpose), and Graduate Record Examination (GRE) scores. A minimum of a 3.0/4.0 undergraduate grade point average is required. All applicants must take the GRE General Test. An additional requirement for admission is identification of a research advisor prepared to accept the applicant as an advisee. Faculty committees are responsible for graduate admission and curriculum.

The Graduate Program in Nutrition and Food Science has a long history of educating graduate students from around the world. However, in addition to standard admission requirements, international applicants must also take the Test of English as a Foreign Language Internet-Based Test (TOEFL IBT) or the International English Language Testing System (IELTS) test. A minimum overall score of 100 on the TOEFL IBT or a 7 on the IELTS is required for full admission. International applicants must also submit documentation of adequate financial support for their studies. Details on the graduate admissions process for international applicants may be found at www.gradschool.umd.edu/prospective_students/international_admissions.html

Application Deadlines

Application Requirements

1. Statement of Purpose
2. GRE General
3. 3 Letters of Recommendation
4. TOEFL scores for international applicants

Graduate Director
Sahyoun, Nadine

Professor
Buchanan, Robert L.
Castonguay, Thomas W.
Jackson, Robert T.
Lei, David K. Y.
Meng, Jianghong
Sahyoun, Nadine
Yu, Liangli

Associate Professor
Wang, Qin

Assistant Professor
Lee, Seong-Ho
Pradhan, Abani K.
Rahaman, Shaik O
Rohan V Tikekar
Song, Hee-Jung

Lecturer
Udahogora, Margaret

Professor Emerita
Moser-Veillon, Phylis B.

Professor Emeritus
Ahrens, Richard A.

5. ITA – international students who wish to be considered for a Teaching Assistant Position are required to be evaluated by Maryland English Institute (MEI) for the English language proficiency to become a International Teaching Assistant (ITA)

Degree Requirements

Master of Science in Nutrition and Food Science (M.S.)
Requirements for the M.S. degree in Nutrition and Food Science are a minimum of 30 graduate credits of course work including a minimum of 12 credits of 600 level courses and a minimum of 6 graduate credits of masters thesis research (NFSC 799). A minimum GPA of 3.0 is required to maintain good academic progress for graduation. Students must complete a thesis and successfully defend their research before a graduate faculty advisory committee approved by the Graduate School. An average duration of a Master's project is 2-3 years depending upon prior education and experience.

Doctor of Philosophy in Nutrition and Food Science (Ph.D.)
Requirements for the Ph.D. degree in Nutrition and Food Science include a mastery of the broad fundamentals of area of specialty, as well as the demonstrated ability to conduct independent research. Course requirements include: a minimum of 27 graduate credits of course work including 9 credits of advanced nutrition/food science courses, beyond the M.S. degree and 12 credits of NFSC 899 Doctoral Dissertation Research. A minimum GPA of 3.0 is required to maintain good academic progress for graduation. Students are admitted to full candidacy for the Ph.D. upon passing a comprehensive exam on basic core knowledge of area of specialty and submittal of a research proposal. In addition the student must prepare and successfully defend a dissertation before their graduate faculty advisory committee. The average duration of a Ph.D. degree program is 4-5 years, depending upon prior education and experience.

Facilities and Special Resources

The Graduate Program office is housed within the Department of Nutrition and Food Science in Room 0112 in the Skinner Building.

Program facilities are located in the Departments of Nutrition and Food Science, Animal and Avian Sciences, Anthropology, Cell Biology and Molecular Genetics, Chemistry and Biochemistry, and Plant Science and Landscape Architecture. There are also collaborative arrangements with the National Institutes of Health (NIH), Food and Drug Administration (FDA), and U.S. Department of Agriculture (USDA). Additionally, opportunities exist for collaborative research with scientists at the FDA through the Joint Institute for Food Safety and Applied Nutrition.

Library facilities and resources are extensive. In addition to campus libraries, the National Archives, the National Agricultural Library, the Library of Congress, and the National Library of Medicine are all within 10 miles of campus and are available to students.

Financial Assistance

Financial support for graduate students is available on a competitive basis. The Department of Nutrition and Food Science offers a number of graduate teaching assistantships that support students in the program. A limited number of research assistantships are also available. Applications for teaching assistantships for the fall semester are due around mid-February for continuing students. New students who are interested in a teaching position should contact their advisor for information. International students who wish to be considered for a teaching assistantship and are not native speakers of English are required by the university to take part in the International Teaching Assistant (ITA) evaluation prior to the start of classes. This includes taking the Test of Spoken English (TSE) and submitting official test scores. International teaching assistants who may have been educated entirely in English and those with a bachelor's and/or master's degree from universities in English-speaking countries must also be evaluated. Decisions regarding teaching assistantships are usually reached by April 1. Graduate teaching assistants receive a stipend plus health insurance. Tuition fees (up to

10 credits per semester) for teaching assistants are waived by the university. Programs in Biochemistry, Chemistry, and Cellular Biology and Molecular Genetics, administered in the corresponding departments, also offer teaching assistantships to qualified students in the Graduate Program in Nutrition and Food Science. Students are encouraged to submit teaching assistantship applications to those programs. A limited number of research assistantships are available from grant funds, with the student assisting in the research supported under the grant. The research often may be applicable to the thesis or dissertation. The tuition for graduate research assistants is charged at the in-state rate and often is paid directly by the supporting grant. In addition, research assistants receive health insurance. Research assistantships generally are not awarded until after students have attended classes and are known to faculty. Additional types of financial aid are available, including a work-study program, grants, fellowships and loans. For more information regarding financial support, please refer to the Graduate School website at www.gradschool.umd.edu.

Contact Information

Assistant Director, Academic Programs/Sara Kao
0112 Skinner Building,
College Park
MD 20742
Telephone: (301) 405-8980
Fax: (301) 314-3313
sarakao@umd.edu

http://nfsc.umd.edu/people/staff

Director of the Graduate Program in Nutrition and Food Science/Nadine Sahyoun
0112 Skinner Building,
College Park
MD 20742
Telephone: 301-405-8774
Fax: 301-314-3313
nsahyoun@umd.edu

http://nfsc.umd.edu/people/faculty/nadine-sahyoun-phd-rd

Courses:

Related Programs and Campus Units

Anthropology
Animal Sciences
Kinesiology
Neuroscience and Cognitive Science
Family Studies

Philosophy (PHIL)

Abstract

The Department of Philosophy offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees with emphasis on contemporary Anglo-American philosophy and the interaction of philosophy with other disciplines. Students often enter the doctorate program without an M.A. degree, but the M.A. may be earned on the way to the Ph.D. While the Ph.D. program is suitable primarily for students who wish to enter a career in teaching and research at the college or university level, the M.A. program is appropriate for those who want to deepen and expand the knowledge they gained as

Faculty:

Chair
Morris, Christopher

Associate Chair
Stairs, Allen

Distinguished Scholar-Teacher
Darden, Lindley
Pietroski, Paul M.

undergraduates or who wish to develop competence in philosophy to apply to some other professional field.

Admissions Information

The Department requires for admission the results of the Graduate Record Examination, three letters of recommendation from previous instructors, and a sample of the student's written work on a philosophical topic (normally an essay, no more than twenty to twenty-five pages). The same supporting documents must be provided for admission to the master's program.

Candidates should normally have completed at least six courses of philosophy (logic, ethics, epistemology, metaphysics, philosophy of mind, and the history of philosophy).

Application Deadlines

Fall:
Applications for admission without financial support must also be received by January 3 .
Applications for admission with financial support (Assistantships or Fellowships) must be received by January 3 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Writing Sample (Philosophy Paper)

Degree Requirements

Doctor of Philosophy (Ph.D.)

Students who seek admission to the Ph.D. program normally should intend to pursue only full-time study toward that degree.

In addition to the Graduate School requirements, students must complete twelve three-hour courses, or a total of thirty-six hours of course work. Two of these courses must be Core Courses, the remaining ten graduate seminars offered by the Department. Additional details may be found in the Graduate Handbook on the Department's www site. Foreign language skills are required only as demanded by the individual student's research.

Partial credit toward the Ph.D. requirements may be awarded for relevant work done at other graduate institutions. The Director of Graduate Studies will make a specific determination in each case.

Master of Arts (M.A.)

Students must complete ten three-hour courses, or a total of thirty hours of course work. Two of these courses must be Core Courses, the remaining eight graduate seminars offered by the Department. Additional details may be found in the Graduate Handbook on the Department's www site: http://www.philosophy.umd.edu.

Facilities and Special Resources

Distinguished University Professor
Bub, Jeffrey
Levinson, Jerrold

Professor
Carruthers, Peter
Greenspan, Patricia S.
Horty, John
Kerstein, Samuel J.
Manekin, Charles H.
Morris, Christopher
Rey, Georges
Stairs, Allen

Associate Professor
Dwyer, Susan
Moller, Dan
Williams, Alexander

Assistant Professor
Lyon, Aidan
Pacuit, Eric
Singpurwalla, Rachel

University Affiliate
Williams, Alexander

Professor Emeritus
Cherniak, Christopher

Associate Professor Emeritus
Brown, John H.

A number of other departments and programs at the University offer graduate students additional opportunities for coursework and research.

In addition to the excellent libraries on campus, students may use other libraries in the Washington/Baltimore metropolitan area, such as the Library of Congress, the Center for Hellenic Studies, and the Eisenhower Library on the campus of Johns Hopkins University.

The Department sponsors a series of colloquia by visiting and local speakers throughout the academic year.

Financial Assistance

The Department administers a number of graduate assistantships and fellowships. Virtually all applicants admitted to the doctoral program are offered support, typically a combination of teaching assistantships and fellowships.

Contact Information

For further information about the program, please consult the Department's www site: http://www.philosophy.umd.edu or contact the Director of Graduate Studies.

Professor Peter Carruthers, Director of Graduate Studies
Department of Philosophy, University of Maryland, College Park
MD 20742
Telephone: (301) 405 5689
Fax: (301) 405 5690
pcarruth@umd.edu

http://www.philosophy.umd.edu

Professor Dan Moller, Director of Graduate Admissions
Department of Philosophy, University of Maryland, College Park
MD 20742
Telephone: (301) 405-2117
Fax: (301) 405 5690
dmoller@umd.edu

http://www.philosophy.umd.edu

Courses: PHIL

Physics (PHYS)

Faculty:

Dean
Banavar, Jayanth

Chair
Baden, Andrew R.

Associate Chair
Cohen, Thomas D.
Shawhan, Peter S.

Co-Director
Clark, Charles W.
Rolston, Steven L.

Abstract

A fuller picture of the Department of Physics can be found on the department's home page, http://umdphysics.umd.edu; only a summary is provided here. The Department of Physics has active research programs in many areas of current interest. The various research groups can be browsed at http://umdphysics.umd.edu/research.html.

Admissions Information

The University of Maryland Department of Physics has a very strong national and international reputation, and receives a large number of applications each year from well-

qualified students. Consequently, admission to the graduate degree program is quite selective.

Students who enter the graduate program are normally expected to have strong backgrounds in physics, including intermediate- or upper-level undergraduate courses in mechanics, electricity and magnetism, physical optics, quantum physics, and thermodynamics. Prior research experience and strong letters of recommendation are highly valued. Excellent preparation in mathematics is also desirable, especially for students who may pursue theoretical physics research.

The Graduate Record Examination (GRE), including the Physics subject test, is generally (but not absolutely) required for admission. The average Physics subject score for students who enroll in the program is about 860, but students with much lower scores (or no scores) are occasionally admitted if the rest of their application shows strong preparation and excellent promise for graduate research in physics. Most admitted students coming from U.S. undergraduate institutions have GPAs above 3.7.

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. University of Maryland Graduate School online application (ApplyYourself)
2. Statement of Purpose
3. Physics Supplementary Application form (listing physics courses and textbooks used)
4. Transcript(s) from your current and previous (if any) institutions
5. GRE General Test scores
6. GRE Physics Subject Test score
7. 3 Letters of Recommendation

International students from most countries have additional English proficiency requirements.

See http://umdphysics.umd.edu/academics/graduate/grad-prospective-students.html for more information.

Degree Requirements

Doctor of Philosophy (Ph.D.)

The requirements for the Doctor of Philosophy degree in physics are set in general terms to allow the individual student as much freedom as possible to prepare a course of study suited to individual needs. These requirements are: competence in basic physics indicated by a satisfactory performance on a qualifying examination; attendance in a departmental research seminar; the giving of an oral Preliminary Research Presentation to demonstrate the ability to organize and orally present a topic of current research interest in physics; a paper as evidence of the ability to organize and present a written scholarly report on contemporary research prior to candidacy; advanced course study outside the student's field of specialization consisting of two advanced courses (six credits), at least one of which must be a physics course at the 700 level or above; PHYS 624 or 625 for students with theoretical theses; and research competence through active participation in at least two hours of seminar, 12 hours of thesis research, and the presentation and defense of an original dissertation.

Director
Drake, James F.
Hoffman, Kara D.
Lobb, Christopher J.

Distinguished Scholar-Teacher
Beise, Elizabeth J.
Cohen, Thomas D.
Dorland, William D.
Eno, Sarah C.
Gates, Sylvester James, Jr.
Goodman, Jordan A.
Jacobson, Theodore A.
Lobb, Christopher J.
Milchberg, Howard M.
Mohapatra, Rabindra N.
Redish, Edward F.

Distinguished University Professor
Das Sarma, Sankar
Drake, James F.
Gates, Sylvester James, Jr.
Goodman, Jordan A.
Jawahery, Abolhassan
Monroe, Christopher
Ott, Edward
Phillips, William D.
Sundrum, Raman
Williams, Ellen D.

Professor
Anlage, Steven
Antonsen, Thomas M., Jr.
Baden, Andrew R.
Banavar, Jayanth
Bedaque, Paulo
Beise, Elizabeth J.
Cohen, Thomas D.
Dorland, William D.
Einstein, Theodore L.
Ellis, Richard F.
Eno, Sarah C.
Galitski, Victor M.
Goodman, Jordan A.
Greene, Richard L.
Hadley, Nicholas J.
Hassam, Adil B.
Hoffman, Kara D.
Hu, Bei-Lok
Jacobson, Theodore A.
Jawahery, Abolhassan
Ji, Xiangdong
Kirkpatrick, Theodore R.
Lathrop, Daniel P.
Lobb, Christopher J.
Losert, Wolfgang
Milchberg, Howard M.
Mohapatra, Rabindra N.
Orozco, Luis A.
Paglione, Johnpierre
Papadopoulos, Konstantinos Dennis
Redish, Edward F.
Rolston, Steven L.
Roy, Rajarshi
Seo, Eun-Suk
Skuja, Andris
Sprangle, Phillip
Sullivan, Gregory W.
Wellstood, Frederick C.
Yakovenko, Victor M.

Master of Science (M.S.)

The Department offers both thesis and non-thesis options in its Master of Science program. However, virtually all students are admitted directly to the Ph.D. program, and obtain a Master's naturally in the course of their Ph.D. studies. A student interested instead in a terminal Master's degree should consult with the physics department. The Departmental requirements for the non-thesis option include: a total of 30 credits excluding research credits; at least four courses of the general physics sequence; a paper as evidence of ability to organize and present a written scholarly report on contemporary research; and the passing at the master's level of one section of the Ph.D. qualifying exam. The thesis option's requirements include at least four courses of the general physics sequence, a graduate laboratory unless specially exempted, and the passing of an oral examination including a defense of thesis.

Facilities and Special Resources

Current research in the Department spans an immense range of theoretical and experimental work on the forefront of knowledge, far too large to describe here. Details of the work in the various fields, and the faculty and facilities involved can be found at the Departmental web site, http://umdphysics.umd.edu . There are many Centers and Institutes focusing on certain areas within the Physics Department or fostering interdisciplinary research with units outside of the department. Some Physics Ph.D. students carry out their research under the guidance of faculty members from different departments, such as Astronomy or Electrical & Computer Engineering.

The University of Maryland is located within the metropolitan area of Washington, D.C., where it enjoys the proximity of a large number of outstanding institutions, such as NASA's Goddard Space Flight Center, the National Institute of Standards and Technology, Naval Research Laboratory, Army Research Laboratory, National Institutes of Health, Johns Hopkins Applied Physics Laboratory, and the Smithsonian Institution. The Department works closely with certain research groups at some of these institutions, and a significant fraction of graduate students do their primary research at off-campus facilities, co-directed by a member of the graduate faculty in the Department. In order to facilitate graduate study in the Washington area, the Department of Physics also has adjunct professors from certain government laboratories.

Financial Assistance

The Department offers both teaching and research assistantships. Combined with fellowships in some cases, virtually all Ph.D. students have full financial support for the duration of their graduate studies. In a typical semester, approximately 50 teaching assistants and 160 research assistants work in the Department, while some others are supported by nearby government and industry facilities at which they are doing their research. Summer research stipends for advanced graduate students are customary, and a few summer teaching assistantships are available.

Contact Information

A Graduate Student Guide is available at http://umdphysics.umd.edu/academics/graduate/grad-requirements.html. This guide describes the graduate program elements and covers the academic and procedural requirements for earning degrees.

Graduate Admissions
1120 Physics Building, Department of Physics
The University of Maryland, College Park
MD 20742
Telephone: (301) 405-5982
Fax: (301) 405-4061
grad@physics.umd.edu

Regents Professor
Gates, Sylvester James, Jr.

Associate Professor
Agashe, Kaustubh
Applebaum, Ian
Chacko, Zacharia
Girvan, Michelle
Hall, Carter R.
Kim, Kiyong
Ouyang, Min
Roberts, Douglas A.
Shawhan, Peter S.
Upadhyaya, Arpita

Assistant Professor
Belloni, Alberto
Manucharyan, Vladimir
McKinney, Jonathan
Sau, Jay Deep
Williams, James R.

Senior Research Scientist
Chang, Chia-Cheh
Currie, Douglas
Mason, Glenn M.
Misner, Charles W.
Pati, Jogesh C.

Research Professor
Alley, Carroll O., Jr.
Anderson, James Robert
Drew, H. Dennis
Fuhrer, Michael
Greenberg, Oscar Wallace
Hamilton, Douglas C.
Liu, Chuan Sheng
Paik, Ho Jung
Park, Robert L.
Venkatesan, T. Venky
Wallace, Stephen J.

College Park Professor
Buonanno, Alessandra
Mather, John C.

Adjunct Professor
Bryant, Garnett W.
Clark, Charles W.
Julienne, Paul S.
Lett, Paul
Lynn, Jeffrey W.
Migdall, Alan
Porto, Trey
Solomon, Glenn
Spielman, Ian
Tiesinga, Eite
Williams, Carl

Adjunct Associate Professor
Campbell, Gretchen
McEnery, Julie
Osborn, Kevin
Taylor, Jacob

Adjunct Assistant Professor
Butch, Nicholas
Gorshkov, Alexey

Affiliate Professor
Hill, Wendell T., III
O'Shea, Patrick

http://www.umdphysics.umd.edu/

Courses: PHYS

Related Programs and Campus Units

Biophysics
Astronomy
Applied Mathematics & Statistics, and Scientific Computation
Chemical Physics
Institute for Physical Sciences and Technology (IPST)
Institute for Research in Electronics and Applied Physics

Oehrlein, Gottlieb
Phaneuf, Raymond J.
Takeuchi, Ichiro
Weeks, John D.

Affiliate Associate Professor
Aranda-Espinoza, Jose Helim
Elby, Andy
Waks, Edo

Affiliate Assistant Professor
Hafezi, Mohammad
Leite, Marina Soares
Mo, Yifei
Munday, Jeremy
Rodriguez, Efrain

Distinguished University Professor Emeritus
Fisher, Michael E.
Gloeckler, George
Sagdeev, Roald Z.
Yorke, James A.

Professor Emeritus
Alley, Carroll O., Jr.
Anderson, James Robert
Bhagat, Satindar M.
Boyd, Derek A.
Brill, Dieter R.
Chang, Chia-Cheh
Chang, Chung-Yun
Chant, Nicholas S.
Currie, Douglas
DeSilva, Alan W.
Dorfman, J. Robert
Dragt, Alex J.
Drew, H. Dennis
Glick, Arnold J.
Goldenbaum, George C.
Greenberg, Oscar Wallace
Griem, Hans R.
Griffin, James J.
Hamilton, Douglas C.
Holmgren, Harry D.
Kim, Young Suh
Korenman, Victor
Langenberg, Donald N.
Layman, John W.
Liu, Chuan Sheng
Mason, Glenn M.
Misner, Charles W.
Paik, Ho Jung
Park, Robert L.
Pati, Jogesh C.
Richard, Jean-Paul
Roos, Philip G.
Sucher, Joseph
Wallace, Stephen J.

Associate Professor Emeritus
Kacser, Claude

Plant Science (PLSC)

Abstract

The Plant Science (PLSC) graduate program offers training with concentrations in Agronomy, Cell Biology, Functional Genomics, Molecular Physiology, Conservation Biology and Ecology, Pathology, and Landscape Ecosystems Management. Students are trained by graduate faculty with an emphasis on interdisciplinary education and mastery

Faculty:

Professor
Culver, James N.
Everts, Kathryne L.
Lea-Cox, John D.
Murphy, Angus S.

of their chosen area of study. All PLSC graduate training is thesis-based, and an emphasis is placed on research and discovery learning rather than coursework. Students work directly with internationally-recognized graduate faculty who are leaders in their disciplines. Students are guided in their studies by a major professor as well as a graduate advisory committee selected by the student from experts on the campus, nearby research institutions, and other universities. The program offers Master of Science and Doctor of Philosophy degrees. Tuition, fees, and stipends of Ph. D students are generally supported by extramural funding or by the department through teaching or graduate research assistantships. M.S. students can be extramurally or self-funded. The objectives of the Plant Science graduate program are: - To provide students with the skills in analyzing and interpreting quantitative and qualitative information; using inductive and deductive reasoning; and communicating in both verbal and written form. - To train a next generation of plant science researchers to lead public and private efforts to provide a secure and nutritious food supply, maintain and restore ecosystems, and provide high quality plant science education. - To advance knowledge in plant sciences that is critical to the improvement of the efficiency, profitability and sustainability of global and national agricultural and natural resources. The Plant Science graduate program seeks to maximize the close association of the many national laboratories (USDA, FDA, NASA, NIST, NIH, DOE, etc.) with have cooperative agreements with the department and the University of Maryland. As a result, graduates of the program are particularly well trained for employment in public and private sector research positions.

Admissions Information

Admission to the program requires a baccalaureate from an accredited college or university in the United States or the equivalent in a foreign country. Applicants are expected to have a 3.0 cumulative grade point average (4.0 scale) in all previous academic work. All applicants must submit Graduate Record Examination (GRE) scores and an acceptable combined score of 310 on the verbal and quantitative portions of the GRE are desirable. Foreign applicants must demonstrate proficiency in English. A minimum TOEFL score of 100 or 7 (IELTS) (paper) is required for admission. Students who are awarded a degree from the U.S., United Kingdom, Anglophone Africa, Anglophone Canada, Ireland, Australia, New Zealand, Singapore, and the Commonwealth Caribbean prior to enrolling in the University of Maryland are not required to submit TOEFL or IELTS. In addition, applicants should have at least 16 credit-hours of prior course work in science and mathematics that includes calculus, physics, organic chemistry, biochemistry, biology, and genetics or statistics.

Application Deadlines

Fall:
All applicant's (Domestic and International) materials must be received by February 1 .
Spring:
All applicant's (Domestic and International) materials must be received by June 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Statement of Purpose (< 500 words)
2. GRE General (required)
3. Letters of Recommendation (3)
4. Description of Research Interest/Work Experience (1,000-1,500 words)
5. Academic Transcripts
6. CV/Resume
7. TOEFL/IELTS (International applicants only)
8. Publications/Presentations (if applicable)
9. Faculty of Interest & Area of Interest (applicants without this information will be delayed for evaluation)

Degree Requirements

Doctor of Philosophy (Ph.D.)

The plan of study approved by the Advisory Committee and the Graduate Program Chair

Sullivan, Joseph H.
Walsh, Christopher S.

Associate Professor
Carroll, Mark J.
Chaverri, Priscila
Coleman, Gary D.
Ellis, Christopher
Kratochvil, Robert James
Myers, David N.
Neel, Maile
Sullivan, John B. (Jack)
Turner, Thomas R.
Xiao, Shunyuan
Zhu, Jianhua

Assistant Professor
Chanse, Victoria
Cook, Kelly
Johnson, Lea
Joseph A. Roberts
Kweon, Byoung-Suk
Micallef, Shirley
Schulz, Burkhard
Swett, Cassandra L.
Tully, Katherine

Professor of Practice
Cohan, Steven N.

Agent
Ristvey, Andrew

Adjunct Professor
Cregan, Perry B.

Affiliate Professor
Chang, Caren
Cooke, Todd J.
Liu, Zhongchi
Sze, Heven

Affiliate Assistant Professor
Peer, Wendy A.

Clinical Assistant Professor
Phillips, William II

must be completed by the end of the third semester of enrollment. Students that lack a M.S. degree in Plant Science or closely related discipline must complete a minimum of 36 semester hours of coursework beyond the B.S. degree. This coursework includes 12 semester hours of PLSC899 (Doctoral Dissertation Research), a minimum of 12 credits hours of courses at the 600 level or higher, PLSC608 (Research Methods) and 1 semester hour of PLSC618 (Advances in Research; Critiquing Primary plant Science Literature) and 1 semester hour of PLSC619 (Seminars in Plant Science and Landscape Architecture). Students must also complete one semester each of 400-level or higher courses in biochemistry, plant physiology, and statistics, which may have already been completed as part of a B.S. degree program. PhD students who possess a M.S. degree in Plant Science or closely related discipline are only required to complete 12 semester hours of PLSC899 (Doctoral Dissertation Research), 2 semester hours of PLSC608 (Research Methods), 1 semester hour of PLSC618 (Advances in Research; Critiquing Primary plant Science Literature) and 1 semester hour of PLSC619 (Seminars in Plant Science and Landscape Architecture).

An oral qualifying examination must be completed satisfactorily before a student is admitted to candidacy. The qualifying examination committee should be nominated by the student in consultation with the Major Professor and approved by the PLSC Graduate Program Chair. The qualifying examination committee consists of five graduate faculty members including one member to serve as the PSLA Departmental Representative. The examination must be attempted at least by the end of the fifth semester of study. Under extenuating circumstances and with written permission of the Graduate Program Chair, this time frame may be extended. At the end of the examination, all members of the committee including the PSLA Departmental Representative vote on the student's performance. Two negative votes constitute failure. Upon successful completion of the examination, the committee recommends to the Graduate Program Chair that the student be admitted to candidacy based on satisfactory performance during the examination. It is the responsibility of the student to submit an application for admission to candidacy when all the requirements for candidacy have been fulfilled. Students failing the qualifying examination may be re-examined once within 6 months of the first examination date. Students may be re-examined only once. Failure to pass the qualifying examination a second time will result in termination of the student's program.

A dissertation based on independent and original research must be submitted to the Plant Science Program and the Graduate School. This dissertation is approved by the Dissertation Examining Committee appointed by the Dean of the Graduate School upon the recommendation of the student's Major Professor. The Major Professor serves as the chairperson of the dissertation examining committee and the student's advisory committee typically serves as members of the examining committee. Committee membership must comply with Graduate School requirements for membership. The submitted dissertation must comply with the University of Maryland Thesis and Dissertation Style Guide.

It is the responsibility of the Major Professor and Student to ensure that all University Research assurances are followed. Research involving human subjects must be approved in advance by the Institutional Review Board (IRB). Research involving the use of vertebrate animals must be approved in advance by the Animal Care and Use Committee. Research using hazardous materials (chemical or biological), recombinant RNA/DNA must be approved in advance by the appropriate University committee.

Master of Science (M.S.)
The plan of study approved by the Advisory Committee and the Graduate Program Chair must be completed prior to the second semester of enrollment. The PLSC Graduate Program requires a minimum of 30 semester hours of coursework beyond the B.S. degree, including 6 hours of Master's Thesis Research (PLSC799; credits greater than 6 of this course will not be counted for degree requirement). A minimum of 12 credits hours must be earned in coursework at the 600 level or higher. Students are required to complete 2 semester hours of PLSC608 (Research Methods) and 1 semester hour of PLSC618 (Advances in Research; Critiquing Primary plant Science Literature) and 1 semester hour of PLSC619 (Seminars in Plant Science and Landscape Architecture). Students must also complete one semester each of 400-level or higher courses in

biochemistry, plant physiology, and statistics, which may have already been completed as part of a B.S. or M.S. degree program.

A thesis must be submitted to the Graduate School. This thesis is approved by the Thesis Examining Committee appointed by the Dean of the Graduate School upon recommendation of the student's Major Professor. The Major Professor serves as the chairperson of the examining committee and the student's advisory committee typically serves as members of the examining committee. Committee membership must comply with Graduate School requirements. The submitted thesis must comply with the University of Maryland Thesis and Dissertation Style Guide.

It is the responsibility of the Major Professor and Student to ensure that all University Research Assurances are followed. Research involving human subjects must be approved in advance by the Institutional Review Board (IRB). Research involving the use of vertebrate animals must be approved in advance by the Animal Care and Use Committee. Research using hazardous materials (chemical or biological), recombinant RNA/DNA must be approved in advance by the appropriate University committee.

Facilities and Special Resources

State-of- the-art facilities for conducting research in plant science are located at the College Park campus in the Plant Science Building and Research Greenhouse Complex. Modern laboratories are equipped for genomic, molecular genetic, cell biological, physiological, and biochemical research in plant science. Equipment and expertise for next generation sequencing, life science imaging, bioinformatics, genomics, proteomics, and metabolomics are available either in the department or on campus. Extensive controlled-environment facilities, including state-of-the-art growth chambers and a large and modern greenhouse complex are complemented by a large network of field research facilities located strategically across the state representing various environments with different climates and soil types. Students have access to computer labs and shared processing arrays and a comprehensive computer center located on campus. The University Libraries on campus and both the National Agriculture Library and Library of Congress located nearby make the library resources accessible to students among the best in the nation. Many of the Department's projects are conducted in cooperation with other departments on campus and with professionals at the Food and Drug Administration facility near the campus and the headquarters of the USDA Agricultural Research Service located three miles from campus in Beltsville. Scientists at the Geologic Survey, the National Academy of Sciences, NASA, National Institutes of Health, Department of Energy, Smithsonian, and National Park Service, as well as other agencies, have cooperated with the Department's faculty on various projects. Scientists from some of these agencies have adjunct appointments in the Department, have taught special courses at the University, and participate on graduate committees.

Financial Assistance

A limited number of graduate teaching assistantships and research assistantships are available in the PSLA Department or other academic units where our affiliated faculty members are located and are awarded to students on a competitive basis. Graduate assistants spend approximately 20 hours per week assisting with teaching or research activities. The remainder of their time is generally occupied by coursework and thesis/dissertation research. Appointments to research and teaching assistantships are for 12 and 10 months, respectively. The PSLA Department or other academic units where our affiliated faculty members are located, however, will cover summer salary of all teaching assistants.

Contact Information

For more specific information on the program, contact:

Dr. Jianhua Zhu, PLSC Graduate Program Chair
Department of Plant Science and Landscape Architecture, University of Maryland, 2130 Plant Sciences Building
MD 20742
Telephone: 301.405.0920
Fax: 301.314.9308
jhzhu@umd.edu

http://psla.umd.edu/academic-programs/plant-biology-biotechnology-programs/plant-biology-and-biotechnology-graduate

Courses: PLSC

Professional Master of Arabic Language (MPAR)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Professional Master of Persian Language (MPPE)

Faculty:

Abstract

Admissions Information

Application Deadlines

Application Requirements

Degree Requirements

Financial Assistance

Courses:

Psychology (PSYC)

Faculty:

Acting Associate Dean
Ball, Gregory

Chair
Blanchard, Jack J.

Abstract

Psychology is a remarkably broad field that studies mind and behavior at all levels of analysis ranging from the micro to the macro; from single cells to complex systems; from individuals to groups and cultures; and from invertebrates to humans. Some of these endeavors connect with the biological sciences and others with the social sciences. As

analytical, methodological, and theoretical advances in one domain increasingly influence developments in another, psychologists collaborate in ever greater numbers with scientists in neighboring disciplines, resulting in new subfields that blend the biological and social sciences.

Our department reflects well this combined diversity of and collaborations among approaches. In recognition of this fact, we organized our training structure into 5 Ph.D. program areas:

- Clinical

- Cognitive and Neural Systems (CNS)

- Counseling

- Developmental

- Social, Decision, and Organizational Science (SDOS)

Research collaborations across areas are common and we encourage students to consider training across areas as well. The Department's doctoral programs in both Clinical and Counseling Psychology have been approved by the American Psychological Association. School Psychology, also an APA approved program, is offered in the College of Education.

Admissions Information

The Department accepts only those applicants who have demonstrated competence for completing the requirements of the doctoral degree. The typical student admitted to the graduate program has an overall undergraduate grade point average of 3.5 or above, a psychology grade point average over 3.5, GRE scores of 160 and above for Verbal and 148 and above for Quantitative, appropriate background experiences, outstanding letters of recommendation, research experience and/or previous relevant work experience, and goals congruent with the program. The Department of Psychology encourages applications from members of racial/ethnic minority groups.

All of the programs offer doctoral level programs and do not accept students who are interested in terminal Master of Science degrees. To be considered for admission for the fall semester, all application materials must be submitted by December 1st of the prior year.

Students admitted to the graduate program often earn the M.S. en route to the Ph.D., however, this varies across specialty areas and the specific requirements within a given specialty area should be consulted. All students must be full-time until completion of all requirements of the doctoral program other than the dissertation have been met.

Application Deadlines

Fall:
Applications must be received by December 1 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General required
2. GRE Subject recommended
3. 3 Letters of Recommendation

Associate Chair
Dougherty, Michael
Stangor, Charles G.

Distinguished Scholar-Teacher
Gelfand, Michele Joy

Distinguished University Professor
Kruglanski, Arie W.

Professor
Barbarin, Oscar
Blanchard, Jack J.
Brauth, Steven E.
Cassidy, Jude Anne
Chronis-Tuscano, Andrea M.
Dooling, Robert J.
Dougherty, Michael
Gelfand, Michele Joy
Hanges, Paul J.
Hill, Clara E.
Lejuez, Carl W.
O'Brien, Karen Mary
Pessoa, Luiz
Stangor, Charles G.

Associate Professor
De Los Reyes, Andres
Herberholz, Jens
Lemay, Edward P.
MacPherson, Laura
Norman, Kent L.
O'Grady, Kevin E.
Roesch, Matthew
Yager, David D.

Assistant Professor
Beier, Jonathan
Bernat, Edward
Dougherty, Lea
Felton, Julia
Glasper Andrews, Erica
Grand, James Andrew
Mohr, Jonathan
Redcay, Elizabeth
Riggins, Tracy
Shackman, Alexander
Slevc, Robert
Wessel, Jennifer

Clinical Assistant Professor
Byrne, Mary "Colleen"

University Affiliate
Salahuddin, Nazish
Vijay, Aditi

Distinguished University Professor Emeritus
Hodos, William
Iwamoto, Derek

Professor Emeritus
Gelso, Charles J.

4. Transcripts
5. Statement of Goals and Research Experiences
6. CV (Current Resume)
7. Supplemental documents requested by area in Counseling and Social, Decision, and Organizational Sciences (SDOS). Supplemental Documents can be found here: http://blog.umd.edu/admissionsrequirements/behavioralsocial-sciences/psychology/.

Degree Requirements

Doctor of Philosophy (Ph.D.)
In addition to a quantitative core consisting of three courses, all students are required to take three core courses in areas outside their specialty program. These core courses are designed to provide a breadth of knowledge in psychology. Additionally, each program has requisite coursework and comprehensive examinations. A minimum of 12 credit hours for the dissertation is required for a doctoral degree. In addition to attending classes, students are expected to take part in research.

Master of Science (M.S.)
The M.S. degree requirements are a research thesis (6 credit hours) and 24 credit hours including two courses in statistics. The department does not offer a terminal M.S. Rather, students admitted to the graduate program often earn the M.S. en route to the Ph.D.

Facilities and Special Resources

The Department shares a building with the Biology Department and is centrally situated on campus near three libraries and the student union. The Department has state-of-the-art laboratories, computer facilities, and video equipment. The geographic location in a suburb of Washington, D.C. provides access to a wide variety of laboratory and training facilities in governmental and other agencies. In addition, we are near the national headquarters for The American Psychological Association and Association for Psychological Science.

The Department follows all regulations involved in the use of human subjects and animals.

Financial Assistance

The Department attempts to provide financial aid for all incoming students, although aid is not guaranteed. The different possible types of financial support include fellowships (nominated by the department), teaching assistantships, research assistantships, work on campus, and funded externships.

Contact Information

Additional information concerning the graduate program including specific specialty area information may be obtained by accessing our website at http://www.psychology.umd.edu

M. Cristina Garcia, Academic Program Specialist
University of Maryland-Department of Psychology Graduate Studies Office 1121 Biology-Psychology Building College Park, MD 20742
MD 20740
Telephone: 301 405-1454
Fax: 301 304-9566
psycgradstudies@umd.edu

psyc.umd.edu

Courses: PSYC PSYC PSYC PSYC

Related Programs and Campus Units

Neuroscience and Cognitive Science
Family Science
Center for Superconductivity Research
Education: Counseling Psychology, School Psychology, and Counselor Education

Public Health: Health Services Ph.D. (PHHS)

Abstract

The goal of this program is to provide interdisciplinary training in research, practice, and policy analysis relevant to the planning, administration, management, and evaluation of health and public health programs. The degree program will prepare students to advance research, policy, and practice to order to improve access, cost, and quality of health services, with a particular emphasis on federal, state, and local health policy. The PhD in Health Services requires a minimum of 50 credits organized in four modules. After module 1 (required core health services research courses), students select a cognate area or track. Potential tracks are: health economics, health policy, health equity/sociology of health, and an interdisciplinary track (developed with advisor's approval). Together with their advisor, students select 5 elective courses in the track of which 2 must be methods courses relevant to the cognate area. After completing the track coursework, students must pass a qualifying exam. All students must take an ethics course, a proposal development course and must pass an oral proposal defense to be admitted to candidacy. After candidacy, students take a graduate seminar, and dissertation credits which culminate in a doctoral dissertation and an oral dissertation defense. For further information go to http://sph.umd.edu/department/hlsa/doctoral-program-health-services-phd

Faculty:

Chair
Kleinman, Dushanka

Professor
Stephen B. Thomas

Associate Professor
Simon-Rusinowitz, Lori

Assistant Professor
Dagher, Rada
Jie Chen
Mortensen, Karoline

Research Associate Professor
Simson, Sharon

Admissions Information

Applications to the Health Services PhD program in the University of Maryland, School of Public Health are processed through the Schools of Public Health Application Services (SOPHAS).

Application Deadlines

Fall:
To be considered for Fall enrollment completed applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Applications for the doctoral program in Health Services are reviewed with consideration to the following criteria:

1. Minimum 3.0 undergraduate GPA
2. Undergraduate and graduate transcripts
3. GRE scores taken within the past 5 years
4. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school
5. Statement of professional goals and interests and their congruence with those of the program
6. Relevant academic and work experience

Applicants to the Ph.D. program in Health Services should be sure to use the PHHS major code when seleting the program on the Graduate School application.

Degree Requirements

Doctor of Philosophy in Health Services (Ph.D.)
Please see the website http://sph.umd.edu/department/hlsa/doctoral-program-health-services-phd

Financial Assistance

Contact Information

Luisa Franzini, Ph.D.
Department of Health Services Administration 3310d SPH Building (#255) University of Maryland College Park
MD 20742
Telephone: 301-405-2470
Fax: 301-405-2542
franzini@umd.edu

http://www.sph.umd.edu/hlsa/

Courses: HLSA

Related Programs and Campus Units

Public Health: Master of Public Health--Biostatistics
Public Health: Master of Health Administration
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Master of Public Health--Epidemiology
Public Health: Maternal and Child Health, Ph.D.
Public Health: Epidemiology Ph.D.
Public Health: Behavioral and Community Health Ph.D.

Public Health: Master of Public Health--Behavioral and Community Health (MBCH)

Abstract

The Department offers graduate study leading to the Master Public Health (MPH) in Behavioral and Community Health and the Doctor of Philosophy degree in Behavioral and Community Health. The graduate programs are designed to prepare behavioral health professionals with specific skills and the ability to implement theoretical knowledge in a practical setting.

The mission of the MPH program is to promote the development of behavioral and community health professionals who understand the science, theory, and practice of public health and can apply this knowledge toward the enhancement of health status of communities. The MPH program is designed as a professional degree to prepare behavioral and community health professionals working in public health service as practitioners, administrators, supervisors, educators, consultants and researchers. Students will participate in both academic and applied training in program planning and implementation, program evaluation, public policy analysis, research, and management.

Faculty:

Chair
Curbow, Barbara

Graduate Director
Sharp, Katherine E.

Distinguished University Professor
Portnoy, Barry

Professor
Beck, Kenneth H.
Boekeloo, Bradley O.
Feldman, Robert H.
Wang, Min Qi

Associate Professor
Arria, Amelia
Desmond, Sharon M.
Green, Kerry
Holt, Cheryl L

Degree programs may be completed either full-time or part-time. All classes are held from either 4:00pm-6:45pm or 7:00pm-9:45pm Monday through Friday. Faculty support coursework, research and practice experiences in many areas, including: health communication; health behavior; adolescent health; women's health; health literacy and health disparities. Faculty hold doctoral degrees in public health, psychology, health education, sociology and epidemiology. The Department offers excellent research and laboratory facilities including the Center for Young Adult Health and Development, the Laboratory for Health Behavior Assessment and Intervention and the Center for Health Behavior Research.

Howard, Donna E.
Sawyer, Robin G.
Zanjani, Faika

Assistant Professor
Butler, James
Fryer, Craig S.
Garza, Mary

Research Professor
Bernat, Debra
Borzekowski, Dina
Clark, Pamela I.

Lecturer
Anderson-Sawyer, Anne
LaTouche-Howard, Sylvette

Admissions Information

An undergraduate GPA of at least 3.0 is required for admission to the MPH program. In addition, the Department requires satisfactory GRE scores, three letters of recommendation, a resume or curriculum vitae, and a statement of purpose from all applicants. For best consideration, completed admission applications (those that include all supporting materials including GRE scores and letters of recommendation) must be received by December 15th to be considered for Fall enrollment. The final deadline in June 1st.

Application Deadlines

Fall:
Complete applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

- 1. GRE General
- 2. Three letters of Recommendation
- 3. Statement of Purpose
- 4. Transcripts from previously attended universities/colleges
- 5. Curriculum Vitae or Resume
- 6. Completed On-line Application

How to Apply: Applications should be submitted through the Schools of Public Health Application Service, SOPHAS, at www.SOPHAS.org. Remember to designate the University of Maryland School of Public Health, College Park, as one of your school choices along with your desired program. The University of Maryland School of Public Health GRE Code in SOPHAS is 0485. SOPHAS will verify the information reported and send it electronically to the University of Maryland School of Public Health once complete. The verification process can take 4-6 weeks to complete. We do not accept materials outside of the SOPHAS process. The University of Maryland requires a Supplemental Application and a Supplemental Application Fee of $75 for each program.

Degree Requirements

Master of Public Health in Behavioral and Community Health (M.P.H.)
The MPH in Behavioral and Community Health is a 42-credit program which includes coursework, an internship, and a MPH project or a thesis. It takes 2 years to complete as a full-time student and 3.5-5.0 years to complete as a part-time student. The program cannot be completed in less than 2 years due to limited course availability. At this time, the overwhelming majority of courses are held in-person on the College Park campus, very few are online.

Facilities and Special Resources

The Department has research specializations in a variety of areas including:

- Minority health/social inequalities in health
- Alcohol and drug abuse
- Safety and health
- Sexual health
- Adolescent health and risk behavior
- Violence prevention/community violence
- Public health communication
- Treatment of nicotine dependence

Specialized laboratories operating within the Department include:

- The Laboratory for Health Behavior Assessment and Intervention
- The Center for Health Behavior Research
- The Center for Young Adult Health and Development

The proximity of the nation's capital, the National Institutes of Health, the National Library of Medicine, the Food and Drug Administration, the Maryland Department of Health and Mental Hygiene, and numerous public health focused private and not-for profit organizations/agencies render the University of Maryland unusually well suited for graduate work in behavioral and community health.

Financial Assistance

The Department offers a limited number of fellowships, and graduate teaching and research assistantships. Contact the Director of Graduate Studies for further information.

Contact Information

For additional information please contact:

Director of Graduate Studies
2387 SPH Building University of Maryland College Park
MD 20742
Telephone: 301-405-2464
Fax: 301-314-9167
ksharp1@umd.edu

http://www.sph.umd.edu/dbch/

Courses: HLTH

Related Programs and Campus Units

Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Master of Public Health--Biostatistics
Public Health: Health Services Ph.D.
Public Health: Master of Public Health--Epidemiology
Public Health: Maternal and Child Health, Ph.D.
Public Health: Epidemiology Ph.D.

Public Health: Master of Health Administration
Public Health: Behavioral and Community Health Ph.D.

Public Health: Master of Public Health--Biostatistics (BIOS)

Abstract

Biostatistics is an important field in the science and practice of public health, relating statistical information to concrete health issues as they affect human populations. Biostatisticians often collaborate with public health and clinical professionals to do research and analyze problems in a range of health sciences, providing evidence needed to make critical decisions. Students with an MPH in Biostatistics degree will be able to assist with the implementation of research studies of human health and disease; design and implement data management systems; design and implement tabular and graphical displays of quantitative information; draw inferences from quantitative data; and use statistical reasoning to deal effectively with public health problems and risk assessment.

Our proximity to the nation's capital offers students unparalleled opportunities for research experiences in public health, including placements at the National Institutes of Health, National Center for Health Statistics, Centers for Disease Control, Food and Drug Administration, the Maryland Department of Health and Mental Hygiene, and many other national, state, and local health agencies.

Admissions Information

Applications should be submitted through the Schools of Public Health Application Service, SOPHAS, at www.SOPHAS.org. The 2015-2016 application cycle opens in SOPHAS in September, 2015, and all application documents must be submitted via SOPHAS. Designate the University of Maryland School of Public Health, College Park, as one of your school choices along with your desired program. The University of Maryland School of Public Health GRE Code is 0485.

The University of Maryland requires a Supplemental Application and a Supplemental Application Fee of $75 for each program. Applicants will receive e-mail instructions for how to complete the Supplemental Application once your SOPHAS application is complete.

Application Deadlines

Fall:
To be considered for Fall enrollment completed applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Applications for the MPH program with concentration in Biostatistics are reviewed with consideration to the following criteria:

1. Minimum 3.0 undergraduate GPA; outstanding performance in quantitative-oriented courses
2. Official GRE scores taken within the past 5 years (GRE scores are required and should be requested directly from ETS for electronic transmission to SOPHAS. The school code is 0485). Scores should be at least in the 50th percentile for each section.
3. Undergraduate transcripts
4. For international applicants a TOEFL score of 100 (www.international.umd.edu/ies/97)

Faculty:

Chair
Gold, Robert S.

Graduate Director
Saksvig, Brit

Professor
Carter-Pokras, Olivia
Gold, Robert S.
Lee, Mei-Ling
Liu, Hongjie

Associate Professor
Lee, Sunmin

Assistant Professor
Chae, David
Chen, Shuo
Dallal, Cher
He, Xin
Penniman, Typhanye
Slopen, Natalie
Zhang, Jing

Research Associate Professor
Saksvig, Brit

Research Assistant Professor
Cruz-Cano, Raul
Jaschek, Graciela

5. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school
6. **Statement of Purpose:** Your statement of purpose should address each of the following questions: 1) describe your specific interest in biostatistics; 2) what previous experiences have influenced your decision to pursue a degree in biostatistics; and 3) how do you believe UMD's program will help you reach your career goals.
7. Relevant academic/work experience, including previous coursework in mathematics, statistical methods, and/or statistical software packages.

Applicants to the MPH program with concentration in Biostatistics should be sure to use the major code BIOS when selecting the program on the Supplemental Application.

Degree Requirements

Master of Public Health with concentration in Biostatistics (M.P.H.)

The MPH with a concentration in biostatistics is a 43 credit professional degree that prepares graduates to work in public health services as practitioners, researchers, administrators, and consultants. A full-time student may complete our program in 2 years. Part-time students may take up to 4 years to complete the program. The majority of courses are offered in the evenings.

In addition to coursework, all biostatistics masters' students are required to complete a capstone experience that occurs after all courses are completed and includes: 1) a project or a thesis (usually data analysis or report suitable for publication); and 2) an internship of at least 240 hours

Facilities and Special Resources

Our faculty in the Department of Epidemiology and Biostatistics includes individuals with multi-faceted interests in biostatistics, epidemiology, and bioinformatics. Biostatistics faculty apply statistical techniques including survival and longitudinal analysis, computational statistics, statistical analysis of genomic and proteomic data, machine learning, neuroimaging statistics, (network) meta-analysis, missing data analysis, Bayesian hierarchical methods, and bioinformatics to analyze and interpret health data. Epidemiology faculty have research interests and expertise in the epidemiology of infectious disease and chronic disease with particular focus in the areas of HIV/STIs, cancer, health disparities, cardiovascular disease, obesity/physical activity, and sexual and reproductive health. Additional areas of specialization include social and behavioral determinants of health, aging, cultural competency, and community-based interventions.

Financial Assistance

Contact Information

Director, Graduate Studies: Brit I. Saksvig, PhD
Department of Epidemiology and Biostatistics School of Public Health 2234 School of Public Health Bldg.(#255)
University of Maryland College Park
MD 20742
Telephone: 301-405-2491
bsaksvig@umd.edu

http://sph.umd.edu/epib/

Courses: EPIB

Related Programs and Campus Units

Public Health: Epidemiology Ph.D.
Public Health: Master of Public Health--Epidemiology
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Health Services Ph.D.
Public Health: Maternal and Child Health, Ph.D.
Public Health: Master of Health Administration
Public Health: Behavioral and Community Health Ph.D.

Public Health: Master of Public Health--Environmental Health Sciences (MIEH)

Faculty:

Professor
Milton, Donald

Associate Professor
Puett, Robin
Sapkota, Amir
Sapkota, Amy R.

Assistant Professor
Payne-Sturges, Devon C.
Quirós-Alcalá, Lesliam
Turner, Paul
Wilson, Sacoby

Abstract

The Maryland Institute for Applied Environmental Health offers a Master of Public Health (MPH) degree with a concentration in Environmental Health Sciences. Environmental Health Science is a discipline that investigates biological, chemical, and physical factors that affect the health of human beings and their communities. Focusing on interrelationships between people and their environments, the discipline seeks to translate environmental health research into effective public health practice; promote human health and well-being; and foster safe and healthy environments. Environmental public health scientists address issues such as the control of epidemic diseases, food and water safety, treatment and disposal of liquid and airborne wastes, elimination of workplace stressors, and the role of environment in chronic illnesses. Environmental health sciences professionals also tackle the effects of long-range problems, including the effects of toxic chemicals and radioactive waste, acidic deposition, depletion of the ozone layer, and global warming on human health.

Admissions Information

To apply to the MPH program with a concentration in Environmental Health Sciences, applicants must complete the University of Maryland Graduate School application and provide additional information as described below under "Application Requirements". The Graduate School application and instructions can be found online at http://www.gradschool.umd.edu/gss/admission.htm.

Application Deadlines

Fall:
To be considered for fall enrollement completed applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Applications for the MPH program with concentration in Environmental Health Sciences are reviewed with consideration to the following criteria:

1. Minimum 3.0 undergraduate GPA
2. Undergraduate transcripts
3. GRE scores taken within the past 5 years
4. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school
5. Statement of goals and interests and their congruence with those of the program

6. Relevant academic/work experience, including previous coursework in biology, chemistry, mammalian physiology, mathematics, statistical methods, and/or statistical software packages.

Applicants to the MPH program with concentration in Environmental Health Sciences should be sure to use the major code MIEH when selecting the program on the Graduate School Application.

Degree Requirements

Master of Public Health with concentration in Environmental Health Sciences (M.P.H.)

The MPH with a concentration in Environmental Health Sciences is a 42-credit professional degree. All MPH students with concentration in Environmental Health Sciences will complete 4 public health core courses, 6 courses in the environmental health sciences cognate area, two elective courses, an internship, and a capstone project or thesis.

Facilities and Special Resources

The proximity of the University of Maryland, College Park to the nation's capital offers prospective students unparalleled opportunities for internships and research experiences in public health, including placements at the National Institutes of Health, the CDC Washington Office, the U.S. Department of Health and Human Services, Children's National Medical Center, the Maryland Department of Health and Mental Hygiene, and many other national, state, and local health agencies. The diversity of cultural and socioeconomic groups, communities, industries, and health organizations provides a rich environment for learning, research, public policy analysis, and service.

Financial Assistance

Contact Information

Maryland Institute for Applied Environmental Health 2234 School of Public Health Building (#255)
University of Maryland College Park
MD 20742
Telephone: 301-405-5509
Fax: 301-314-1012
miaeh@umd.edu

http://www.sph.umd.edu/miaeh/

Courses: MIEH

Related Programs and Campus Units

Public Health: Master of Public Health--Biostatistics
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Master of Public Health--Epidemiology
Public Health: Health Services Ph.D.
Public Health: Maternal and Child Health, Ph.D.
Public Health: Epidemiology Ph.D.
Public Health: Master of Health Administration
Public Health: Behavioral and Community Health Ph.D.

Public Health: Master of Public Health--Epidemiology (EPDM)

Abstract

The Department of Epidemiology and Biostatistics offers a Master of Public Health (MPH) program with a concentration in Epidemiology. Epidemiology is the study of the distribution and determinants of disease and injuries, and other health states in human populations. As the fundamental science of public health practice, epidemiology provides the conceptual and applied tools necessary for the study of public health problems. Our program emphasizes training in the application of epidemiologic methods to the study of disease occurrence, prevention, and control. Our faculty in the Department of Epidemiology and Biostatistics includes individuals with multi-faceted interests in both epidemiology and biostatistics.

Our proximity to the nation's capital offers students unparalleled opportunities for research experiences in public health, including placements at the National Institutes of Health, National Center for Health Statistics, Centers for Disease Control, Food and Drug Administration, the Maryland Department of Health and Mental Hygiene, and many other national, state, and local health agencies.

Admissions Information

Applications should be submitted through the Schools of Public Health Application Service, SOPHAS, at www.SOPHAS.org. The 2015-2016 application cycle opens in SOPHAS in September, 2014, and all application documents must be submitted via SOPHAS. Remember to designate the University of Maryland School of Public Health, College Park, as one of your school choices along with your desired program. The University of Maryland School of Public Health GRE Code in SOPHAS is 0485.

The University of Maryland requires a Supplemental Application and a Supplemental Application Fee of $75 for each program. Applicants will receive e-mail instructions for how to complete the Supplemental Application once your SOPHAS application is complete.

Application Deadlines

Fall:
To be considered for fall enrollment completed applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

Applications for the MPH program with concentration in Epidemiology are reviewed with consideration to the following criteria:

1. Minimum 3.0 undergraduate GPA; outstanding performance in quantitative-oriented courses
2. Undergraduate transcripts
3. Official GRE scores taken within the past 5 years (GRE scores are required and should be requested directly from ETS for electronic transmission to SOPHAS. The school code is 0485). Scores should be at least in the 50th percentile for all sections.
4. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school
5. **Statement of Purpose:** your statement of purpose should address each of the following questions: 1) describe your specific interest in epidemiology; 2) what previous experiences have influenced your decision to pursue a degree in epidemiology; and 3) how do you believe UMD's program will help you reach your career goals.

Faculty:

Chair
Gold, Robert S.

Graduate Director
Saksvig, Brit

Professor
Carter-Pokras, Olivia
Lee, Mei-Ling
Liu, Hongjie

Associate Professor
Lee, Sunmin

Assistant Professor
Chae, David
Chen, Shuo
Dallal, Cher
He, Xin
Penniman, Typhanye
Slopen, Natalie
Zhang, Jing

Research Associate Professor
Saksvig, Brit

Research Assistant Professor
Cruz-Cano, Raul
Jaschek, Graciela

6. Relevant academic/work experience, including previous coursework in human biology or physiology, and statistical methods.

Applicants to the MPH program with concentration in Epidemiology should be sure to use the major code EPDM when selecting the program on the Supplemental Application.

Degree Requirements

Master of Public Health with concentration in Epidemiology (M.P.H.)

The MPH with a concentration in Epidemiology is a 43-credit professional degree that prepares graduates to work in public health services as practitioners, researchers, administrators, and consultants. A full-time student may complete our program in 2 years. Part-time students may take up to 4 years to complete the program. The majority of courses are offered in the evenings. In addition to coursework, all epidemiology masters' students are required to complete a capstone experience that occurs after all courses are completed and includes: 1) a project or a thesis (usually data analysis or report suitable for publication); and 2) an internship of at least 240 hours.

Facilities and Special Resources

The Department of Epidemiology and Biostatistics faculty includes individuals with multi-faceted interests in both epidemiology and biostatistics. Our faculty has multi-faceted interests and expertise in the epidemiology of infectious disease and chronic disease with particular focus in the areas of HIV/STIs, cancer, health disparities, cardiovascular disease, obesity/physical activity, and sexual and reproductive health. Additional areas of specialization include social and behavioral determinants of health, aging, cultural competency, and community-based interventions. Biostatistics faculty apply statistical techniques including survival and longitudinal analysis, computational statistics, statistical analysis of genomic and proteomic data, machine learning, neuroimaging statistics, (network) meta-analysis, missing data analysis, Bayesian hierarchical methods, and bioinformatics to analyze and interpret health data.

Financial Assistance

Contact Information

Director, Graduate Studies: Brit I. Saksvig, PhD
Department of Epidemiology and Biostatistics School of Public Health 2234 School of Public Health Bldg.(#255)
University of Maryland College Park
MD 20742
Telephone: 301-405-2491
bsaksvig@umd.edu

http://sph.umd.edu/epib/

Courses: EPIB

Related Programs and Campus Units

Public Health: Epidemiology Ph.D.
Public Health: Master of Public Health--Biostatistics
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Health Services Ph.D.
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Behavioral and Community Health Ph.D.

Public Health: Maternal and Child Health, Ph.D. (MCHS)

Abstract

Maternal and Child Health is an interdisciplinary field in which empirical research, epidemiological data, and policy analyses are used to understand individual, family, community, and sociocultural factors that influence health behaviors, health outcomes, and use of health services by mothers, children, adolescents, and their families (including fathers). The MCH program prepares students to advance research, policy, and practice to improve the health, safety, and well-being of these groups, with a particular emphasis on low income and ethnic minority populations. The program equips students to address MCH issues at both the family and population levels. It is unique in its focus on the whole family system and family health policy.

Ph.D. graduates in MCH are prepared for academic and research positions in colleges and universities; high level administrative or research positions in city/county/state/national health and human service agencies; and leadership positions in nongovernmental and advocacy organizations. MCH graduates are also increasingly hired by private health care organizations such as hospitals, HMOs, and health insurers.

Admissions Information

The Department seeks imaginative, intelligent, and highly motivated students with a desire for challenge, a commitment to excellence, and a well-developed sense of social responsibility. Applicants must have a Master's Degree in Public Health or a relevant behavioral or social science discipline. Students with Master's Degrees other than an MPH must complete missing courses (biostatistics, epidemiology) within one academic year of their entry into the program.

We are fortunate to attract gifted students who are concerned about public health, social and ethical issues and who view their future profession in a broad context.

Students are selected on the basis of:

- performance in previous undergraduate and/or graduate coursework
- the strength of GRE scores taken within the last five years
- letters of recommendation
- quality of empirical Master's Thesis (for those with a Master's degree)
- relevant work experience
- professional goals congruent with those of the program

Application Deadlines

Fall:
Applications and all supporting materials must be received by January 15th .

Application Requirements

Applicants to the MCH Ph.D. program should have an MPH degree or a social/behavioral science master's degree that focuses on family, maternal, and/or child health issues (including mental health). Students without the MPH degree must complete the required 5 public health core courses (biostatistics, epidemiology, environmental health, health services administration, and social and behavioral sciences) within one academic year of their entry into the program. Applicants should also have a minimum undergraduate GPA of 3.0 and a minimum graduate GPA of 3.0.

Faculty:

Chair
Anderson, Elaine A.

Professor
Epstein, Norman B.
Hofferth, Sandra L.
Koblinsky, Sally A.
Quinn, Sandra Crouse

Associate Professor
Bynum, Mia Smith
Kim, Jinhee
Leslie, Leigh A.
Randolph, Suzanne M.
Roy, Kevin
Shenassa, Edmond D.

Assistant Professor
Lewin, Amy
Steinberg, Julia

Professor of Practice
Kessel, Saumuel 'Woodie'

Professor Emerita
Braun, Bonnie

Associate Professor Emerita
Wallen, Jacqueline

Important: Applicants to the Maternal and Child Health Ph.D. program are required to submit two applications for admission. First, they will submit an application to SOPHAS and second, they will submit a separate application to the University of Maryland.

Go to http://www.sophas.org/ to fill out an application to SOPHAS. An application to the SOPHAS system is $120, which will cover all public health programs to which a student chooses to apply. All applicants to the MCH program must submit the following supporting documentation:

- The SOPHAS application form
- Official transcripts from all academic institutions from which you earned credit
- Official GRE test scores, taken within the last 5 years (Institution Code: 0485)
- Three letters of recommendation
- Statement of Purpose and Objectives
- CV/Resume

Approximately one week after application to SOPHAS, applicants will receive an email from the University of Maryland College Park Graduate School with instructions for completing the second supplemental application. They will be directed to the application and a $75 non-refundable fee will be processed when it is submitted. Students submit the following information:

- Maryland Residency Information
- Emergency Contact Information
- Demographics

All information required for this application should be submitted on-line and will be sent directly by Graduate Admission to the Department of Family Science for review. No additional hard copies are required.

Standardized test scores (GREs) are to be sent directly from Educational Testing Service (if no category exists on ETS form, please fill in “other” and write FMSC, code 5814). GREs must be taken in time to reach our department before the December 15th deadline. Allow 2 weeks to receive your scores.

Degree Requirements

Doctor of Philosophy (Ph.D.)

The Maternal and Child Health Ph.D. program requires 51 graduate credit hours beyond the master's degree, including a maternal and child health core (27 credits), a research methods core (12 credits), and the dissertation (12 credits). Students in the PhD program advance to candidacy after completing required coursework, completing a research internship paper, and passing a written qualifying examination. After advancement to candidacy, students must complete a dissertation proposal and oral defense, followed by doctoral dissertation and oral dissertation defense.

This program provides interdisciplinary training in research, practice, and policy relevant to health problems and services for women, infants, children, adolescents, and their families (including men). The MCH program prepares students to advance research, policy and practice to improve the health, safety, and well-being of these groups, with a particular emphasis on low income and ethnic minority populations.

Students admitted full-time to the Ph.D. program post-master's can complete this program within 3-4 years.

Facilities and Special Resources

The University's close proximity to the nation's capital, the state capital in Annapolis, federal executive departments, and headquarters of national professional and public interest associations provide research and internship placements for studying family policy unmatched by any other graduate program in the discipline. The Washington-Baltimore metropolitan area offers rich opportunities for research on culturally and socioeconomically diverse families. The campus and department have excellent computer facilities. Students have ready access to the University's extensive library systems, as well as holdings from the Library of Congress, the National Institutes of Health, National Library of Medicine, National Archives, and many other library collections.

The Center for Healthy Families is the training and research arm of the Couple and Family Therapy Program in the Department of Family Science. Departmental graduate students and faculty provide clinical and educational services to families from surrounding communities in this state-of-the-art facility. Master's and doctoral students use data collected at the Center for research projects.

Financial Assistance

Fellowships and Graduate Assistantships are available to students admitted into the MCH Ph.D program.

Contact Information

For additional information, please contact: Dr. Sandra Hofferth (MCH Program Director) or Dr. Kevin Roy (Graduate Director).
Maternal and Child Health Ph.D. Program
Department of Family Science
1142 School of Public Health, Bldg. 255
College Park, MD 20742
Phone: 301-405-3672
Fax: 301-314-9161
http://www.sph.umd.edu/fmsc

Program Director of the Maternal and Child Health Ph.D. Program
Sandra Hofferth, Ph.D.
Department of Family Science 1142 School of Public Health, Bldg. 255
College Park
MD 20740
Telephone: 301-405-8501
Fax: 301-314-9161
hofferth@umd.edu

Courses:

Related Programs and Campus Units

Family Science
Public Health: Master of Public Health--Biostatistics
Public Health: Health Services Ph.D.
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Epidemiology Ph.D.
Public Health: Behavioral and Community Health Ph.D.

Public Health: Behavioral and Community Health Ph.D. (BCHL)

Abstract

The Department offers graduate study leading to the Master Public Health (MPH) in Behavioral and Community Health and the Doctor of Philosophy degree in Behavioral and Community Health. The graduate programs are designed to prepare behavioral and community professionals with specific skills and the ability to implement theoretical knowledge in a practical setting.

The goal of the doctoral program is to develop health professionals competent in understanding the health needs of populations who are qualified to conduct research in order to implement programs and policies aimed at improving the public's health. This program is very selective and admission is competitive. The program provides students with the opportunity to develop research skills essential in making significant contributions to the scientific and professional literature in behavioral and community health.

Degree programs may be completed either full-time or part-time, although full-time is preferred. Faculty support coursework, research and practice experiences in many areas, including: health communication; health behavior; adolescent health; women's health; health literacy and health disparities. Faculty hold doctoral degrees in public health, psychology, health education, sociology and epidemiology. The Department offers excellent research and laboratory facilities including theLaboratory for Health Behavior Assessment and Intervention, and The Center for Health Behavior Research

Admissions Information

For admission to the doctoral program, the Department requires an undergraduate GPA of 3.0 (if a masters degree has not been obtained) and/or a graduate GPA of 3.5. In addition, the Department requires satisfactory GRE scores, three letters of recommendation, a resume or curriculum vitae, and a statement of purpose from all applicants. Completed admission applications (those that include all supporting materials including GRE scores and letters of recommendation) must be received by November 15th for best consideration. February 15th is the final deadline to be considered for Fall enrollment.

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Statement of Purpose
4. Transcripts from all previously attended universities/colleges
5. Curriculum Vitae or Resume

How to Apply: Applications should be submitted through the Schools of Public Health Application Service, SOPHAS, at www.SOPHAS.org. Remember to designate the University of Maryland School of Public Health, College Park, as one of your school choices along with your desired program. The University of Maryland School of Public Health GRE Code in SOPHAS is 0485. SOPHAS will verify the information reported and send it electronically to the University of Maryland School of

Faculty:

Chair
Curbow, Barbara

Associate Chair
Sawyer, Robin G.

Distinguished University Professor
Portnoy, Barry

Professor
Beck, Kenneth H.
Boekeloo, Bradley O.
Curbow, Barbara
Feldman, Robert H.
Gold, Robert S.
Wang, Min Qi

Associate Professor
Arria, Amelia
Desmond, Sharon M.
Holt, Cheryl L
Howard, Donna E.
Sawyer, Robin G.

Assistant Professor
Butler, James
Fryer, Craig S.
Garza, Mary
Green, Kerry

Research Professor
Bernat, Debra
Borzekowski, Dina
Clark, Pamela I.

Senior Lecturer
Sharp, Katherine E.

Lecturer
Anderson-Sawyer, Anne
LaTouche-Howard, Sylvette

Public Health once complete. The verification process can take 4-6 weeks to complete. We do not accept materials outside of the SOPHAS process. The University of Maryland requires a Supplemental Application and a Supplemental Application Fee of $75 for each program.

Degree Requirements

Doctor of Philosophy in Behavioral and Community Health (BCHL)
The PhD in Behavioral and Community Health is a 48 to 75 credit program depending on the number of course requirements that can or cannot be waived. This research-intensive degree includes coursework, qualifying exams, and individual research that results in a dissertation.

Facilities and Special Resources

The Department has research specializations in a variety of areas including:

- Minority health/social inequalities in health
- Alcohol and drug abuse
- Safety and health
- Sexual health
- Adolescent health and risk behavior
- Violence prevention/community violence
- Public health communication
- Health literacy
- Treatment of nicotine dependence

Specialized laboratories operating within the Department include:

- The Center for Young Adult Health and Development
- The Laboratory for Health Behavior Assessment and Intervention
- The Center for Health Behavior Research

The proximity of the nation's capital, the National Institutes of Health, the National Library of Medicine, and Food and Drug Administration, the Maryland Department of Health and Mental Hygiene, and numerous public health focused private and not-for-profit organizations/agencies render the University of Maryland unusually well suited for graduate work in behavioral and community health.

Financial Assistance

The Department offers a limited number of fellowships, and graduate teaching and research assistantships. Please contact the Director of Graduate Studies for further information.

Contact Information

For additional information please contact:

Director of Graduate Studies
2387 SPH Building, Valley Drive
College Park
MD 20742
Telephone: (301) 405-2464
Fax: (301)314-9167
ksharp1@umd.edu

http://www.sph.umd.edu/dbch/

Courses: HLTH

Related Programs and Campus Units

Public Health: Master of Public Health--Biostatistics
Public Health: Health Services Ph.D.
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Epidemiology Ph.D.
Public Health: Master of Public Health--Epidemiology
Public Health: Maternal and Child Health, Ph.D.
Public Health: Master of Health Administration

Public Health: Epidemiology Ph.D. (EPID)

Abstract

The Department of Epidemiology and Biostatistics is pleased to offer a Ph.D. program in Epidemiology. Students in the PhD program in Epidemiology master core knowledge in epidemiologic and biostatistical methods related to the design, implementation and evaluation of public health studies surrounding psychosocial, behavioral, biological, and cultural factors. Students may work with their advisor to design their own research specialization or they may apply to one of our two specializations: 1) Social Epidemiology or 2) Environmental Epidemiology.

Our students have full access to faculty who will guide you through all phases of the program to ensure your educational goals are met. Our Washington, DC area location provides unparalleled opportunities for research experiences in public health, including placements at the U.S. Department of Health and Human Services (e.g., National Institutes of Health, National Center for Health Statistics), Children's National Medical Center, the Maryland Department of Health and Mental Hygiene, and many other national, state, and local health agencies.

Admissions Information

Applications should be submitted through the Schools of Public Health Application Service, SOPHAS at www.SOPHAS.org. The 2015-2016 application cycle opens in SOPHAS in September and all application documents must be submitted via SOPHAS. Remember to designate the University of Maryland School of Public Health, College Park, as one of your school choices along with your desired program. The University of Maryland School of Public Health GRE Code in SOPHAS is 0485.

The University of Maryland requires a Supplemental Application and a Supplemental Application Fee of $75 for each program. Applicants will receive e-mail instructions for how to complete the Supplemental Application once your SOPHAS application is complete. The doctoral program in Epidemiology accepts only full-time students.

Application Deadlines

Fall:
To be considered for Fall enrollment completed applications must be received by January 15 .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Faculty:

Chair
Gold, Robert S.

Graduate Director
Saksvig, Brit

Professor
Carter-Pokras, Olivia
Lee, Mei-Ling
Liu, Hongjie

Associate Professor
Lee, Sunmin

Assistant Professor
Chae, David
Chen, Shuo
Dallal, Cher
He, Xin
Penniman, Typhanye
Slopen, Natalie
Zhang, Jing

Research Associate Professor
Saksvig, Brit

Research Assistant Professor
Cruz-Cano, Raul
Jaschek, Graciela

Application Requirements

Applications for the doctoral program in Epidemiology are reviewed with consideration to the following criteria:

1. Master's Degree (MPH, MHS, MA, MS)
2. Minimum 3.0 undergraduate GPA
3. Undergraduate and graduate transcripts
4. Official GRE scores taken within the past 5 years (GRE scores are required and should be requested directly from ETS for electronic transmission to SOPHAS. The school code is 0485). Scores should be at minimum in the 50th percentile for each section.
5. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school
6. **Statement of Purpose:** the statement of purpose should address each of the following questions: 1) describe your specific areas of interest within epidemiology; 2) which primary faculty members in the Department of Epidemiology and Biostatistics do you think most closely share your areas of interest; 3) what previous experiences have influenced your decision to pursue a degree in epidemiology; 4) how do you believe UMD's program will help you reach your career goals; and 5) how do you see yourself using this degree in the five years following graduation?
7. Relevant academic/work experience, including previous coursework in human biology or physiology, demonstration of proficiency in statistical methods and statistical software, and research presentation or publication experience.

Applicants are strongly recommended to communicate with the epidemiology faculty member in their area(s) of interest before applying. Applicants should also be sure to use the major code EPID when selecting the program on the Supplemental Application.

Degree Requirements

Doctor of Philosophy in Epidemiology (Ph.D.)

The PhD in Epidemiology requires a minimum of 64 credit hours beyond the master's degree in epidemiology or public health, including 12 credit hours of dissertation research. If an entering student does not have an MPH degree prior to entering the program they will have to complete 15 additional credits for these fundamental courses. Students entering the program with a master's degree in a field other than epidemiology are required to take MPH courses in epidemiology and biostatistics to gain competency in these content and method areas. A minimum of 12 credit hours in a specialization cognate area is required for specialization (included in the 64 credits).

Students admitted to the Ph.D. program advance to candidacy upon completing required coursework and passing a written comprehensive examination with an oral defense. After advancement to candidacy, students must complete a dissertation proposal and oral defense, followed by successful completion of the doctoral dissertation and oral defense.

Working closely with their advisor, students will develop a course of study best suited to meet their specific research interests. Applicants may tailor their specialization to a specific research area or they may select to apply to one of the following specializations: social epidemiology or environmental epidemiology.

Social Epidemiology Specialization: In addition to mastering the core knowledge in epidemiologic and biostatistical methods, students in the social epidemiology specialization will master core knowledge in social and behavioral epidemiologic methods such as community-based participatory research, multi-level modeling of neighborhood effects, examination of pathways linking discrimination and health, and analysis of social and risk networks.

Environmental Epidemiology Specialization: In addition to mastering the core knowledge in epidemiologic and biostatistical methods, students will gain training and experience in state of the art methods for examining the human health impacts of environmental exposures from air, water, food and the built environment. The concentration also provides knowledge and skills in the application of environmental epidemiology to occupational health, community health, risk assessment, environmental justice, health disparities, and global health. This specialization is a cross-disciplinary program between the Department of Epidemiology and Biostatistics and the Maryland Institute for Applied Environmental Health.

Facilities and Special Resources

The Department of Epidemiology and Biostatistics faculty includes individuals with multi-faceted interests in both epidemiology and biostatistics. Our faculty have research interests and expertise in the epidemiology of infectious disease and chronic disease with particular focus in the areas of HIV/STIs, cancer, health disparities, cardiovascular disease, obesity/physical activity, and sexual and reproductive health. Additional areas of specialization include social and behavioral determinants of health, aging, cultural competency, and community-based interventions. Biostatistics faculty apply statistical techniques including survival and longitudinal analysis, computational statistics, statistical analysis of genomic and proteomic data, machine learning, neuroimaging statistics, (network) meta-analysis, missing data analysis, Bayesian hierarchical methods, and bioinformatics to analyze and interpret health data.

Financial Assistance

The Department offers a limited number of fellowships, and graduate teaching and research assistantships.

Contact Information

Director of Graduate Studies, Brit I. Saksvig, PhD
Department of Epidemiology and Biostatistics School of Public Health 2234 School of Public Health Bldg.(#255)
University of Maryland College Park
MD 20742
Telephone: 301-405-2491
bsaksvig@umd.edu

http://sph.umd.edu/epib/

Courses: EPIB

Related Programs and Campus Units

Public Health: Master of Public Health--Epidemiology
Public Health: Master of Public Health--Biostatistics
Public Health: Health Services Ph.D.
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Maternal and Child Health, Ph.D.
Public Health: Master of Health Administration
Public Health: Behavioral and Community Health Ph.D.
Family Science

Public Health: Master of Health Administration (HLSA)

Faculty:

Abstract

The Master of Health Administration (MHA) program at the University of Maryland, College Park offers students a rigorous, multi-disciplinary program with courses in public health services administration, epidemiology, environmental health, biostatistics, health behaviors and determinants, health policy, health law and ethics, health economics and analysis, strategic management of human resources, health service information systems, financial management of health organizations, marketing for competitive health service, quality assessment and evaluation, and health care leadership and communications. The 46-credit professional degree will prepare graduates to manage the many complex health-related organizations including hospitals, long term care facilities, managed care organizations, rehabilitation agencies, public health clinics, state agencies, among others. With the impending retirement of the first wave of baby boomers, public health and health care organizations face large scale losses of middle and executive level administrators. Public health and health services now comprise the largest industry in the United States, producing nearly one seventh of the United States' gross national product. According to the World Health Report 2000, the health care system should be conceptualized as including not only health services, but also public health and social welfare activities. The Department of Health Services Administration adopts this integrated approach to address current health needs, provide leadership in a rapidly evolving health care industry, and anticipate future health challenges in an expanding global economy. The MHA program is considered to be equivalent to the MPH and is accredited by the Council on Education for Public Health (CEPH).

Chair
Kleinman, Dushanka

Professor
Stephen B. Thomas

Associate Professor
Simon-Rusinowitz, Lori

Assistant Professor
Dagher, Rada
Jie Chen
Mortensen, Karoline

Research Associate Professor
Simson, Sharon

Admissions Information

Applications to the MHA program in the University of Maryland School of Public Health are processed through the Schools of Public Health Application Service (SOPHAS).

Application Deadlines

Fall:
All materials must be received by January 15 .

Application Requirements

Applications for the MHA program are reviewed with consideration to the following criteria:

1. Minimum 3.0 undergraduate GPA
2. Undergraduate and graduate transcripts (if applicable)
3. GRE scores taken within the past 5 years
4. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school
5. Statement of professional goals and interests and their congruence with those of the program
6. Relevant academic and work experience

Applicants for the Master of Health Administration degree should be sure to the use the HLSA major code when selecting the program on the Graduate School application.

Degree Requirements

Master of Health Administration (M.H.A.)
Please see the website http://sph.umd.edu/department/hlsa/master-health-administration-mha-program

Financial Assistance

Contact Information

Dr. Luisa Franzini
Department of HLSA School of Public Health 3310 SPH Building University of Maryland
College Park
MD 20740
Telephone: 301-405-2470
Fax: 301-405-2542
franzini@umd.edu

http://www.sph.umd.edu/hlsa/

Courses:

Related Programs and Campus Units

Public Health: Master of Public Health--Biostatistics
Public Health: Health Services Ph.D.
Public Health: Master of Public Health--Behavioral and Community Health
Public Health: Master of Public Health--Environmental Health Sciences
Public Health: Epidemiology Ph.D.
Public Health: Behavioral and Community Health Ph.D.

Public Health: Master of Public Health in Public Health Practice and Policy (PHPP)

Faculty:

Abstract

Healthcare is the largest industry in the U.S. and employs over 11 million workers. 21st century health care professionals require cutting-edge knowledge and exemplary leadership skills to enable their organizations to rise to societal, technological, ethical, financial, and public health challenges. To meet the growing demand for skilled health care professionals, the Department of Health Services Administration, School of Public Health, at the University of Maryland offers two exceptional professional learning opportunities in Public Health Practice. The Master of Public Health in Public Health Practice and Policy (MPH-PHPP) is designed to provide working professionals with the broad range of knowledge and skill-based competencies needed to assume leadership roles in addressing important public health practice and policy issues nationally and globally. The Graduate Certificate in Principles of Public Health (GC-PPH) provides working professionals with a rigorous, multi-disciplinary foundation in the five core areas of public health, advancing understanding of the science of public health. Both programs offer courses in the fall and spring semester (16 weeks each) and Summer Term (two 6-week sessions). The curriculum and degrees have the same content, quality, and high standards as the University's traditional on-site curriculum and reflects the broad range of knowledge and skill-based competencies germane to public health practice in the 21st century. Instruction is delivered by School of Public Health faculty and experts from prominent public health organizations. The School of Public Health is accredited by the Council on Education for Public Health.

Admissions Information

Admission Information for the MPH in Public Health Practice and Policy and the Graduate Certificate in Principles of Public Health can be found here: http://oes.umd.edu/professional-programs/public-health/admission-information UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS).

Additional Requirements can be found here: http://oes.umd.edu/professional-programs/public-health/admission-information#international

Application Deadlines

Application Requirements

Application requirements for the MPH in Public Health Practice and Policy and the Graduate Certificate in Principles of Public Health can be found here: http://oes.umd.edu/professional-programs/public-health/admission-information#qualifications

Degree Requirements

Graduate Certificate in Principles of Public Health (Z076)
The Graduate Certificate in Principles of Public Health (GC-PPH) provides working professionals with a rigorous, multi-disciplinary foundation in the five core areas of public health, advancing understanding of the science of public health. For program description, please see http://sph.umd.edu/department/hlsa/certificate-principles-public-health

Master of Public Health in Public Health Practice and Policy (PHPP)
The Master of Public Health in Public Health Practice and Policy (MPH-PHPP) is designed to provide working professionals with the broad range of knowledge and skill-based competencies needed to assume leadership roles in addressing important public health practice and policy issues nationally and globally. For program description, please see http://sph.umd.edu/department/hlsa/mph-public-health-practice-and-policy

Facilities and Special Resources

The Master of Public Health in Public Health Practice and Policy instruction is delivered in a blended learning format with stimulating on-line courses supplemented by a total of six weekends of residency. On-site weekend sessions are held at the Universities at Shady Grove: 9630 Gudelsky Drive Rockville, MD 20850. For more information, please see: http://oes.umd.edu/professional-programs/public-health#master The Graduate Certificate in Principles of Public Health is delivered in an online format. For more information, please see: http://oes.umd.edu/professional-programs/public-health#certificate

Financial Assistance

Contact Information

Office of Extended Studies or Negin Fouladi
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu or fouladi@umd.edu

http://oes.umd.edu/professional-programs/public-health

Courses:

Public Health: Master of Public Health--Physical Activity (PHAC)

Please note, this page contains information about the MPH degree with concentration in Physical Activity. The Department of Kinesiology also offers the MA and PhD

Faculty:

Professor
Andrews, David L.
Clark, Jane E.
Hagberg, James M.

degrees. **For more information about the MA and PhD degrees in Kinesiology, please refer to the Graduate Catalog listing for Kinesiology.**

Abstract

The Master of Public Health (MPH) degree with a concentration in Physical Activity is a 43-credit professional degree, administered by the Department of Kinesiology. All MPH students with concentration in Physical Activity will complete five public health core courses, eight courses in the physical activity and related cognate area, an internship, and a capstone project.

Admissions Information

Students may qualify for admission with a 3.0 GPA, strong GREs [50th percentile as minimums in the Verbal and Quantitative sections (approximately 150 in each section); 4.0 minimum in Analytical Writing], and a minimum of three strong recommendations from people knowledgeable about the applicant's prior academic achievements and research potential. Applicants will submit a focused letter detailing academic and career goals relevant to the degree program. Appropriate background course work closely aligned with the intended degree specialization is expected.

Application Deadlines

Application Requirements

Admission Application for MPH in Physical Activity: How to Apply:

> MPH applications should be submitted through the Schools of Public Health Application Service, SOPHAS, at www.SOPHAS.org. The application cycle opens in SOPHAS typically in September, and all application documents must be submitted via SOPHAS. Remember to designate the University of Maryland School of Public Health, College Park, as one of your school choices along with your desired program. The University of Maryland School of Public Health GRE Code in SOPHAS is 0485.
> SOPHAS will verify the information reported and send it electronically to the University of Maryland School of Public Health once complete. The verification process can take 4-6 weeks to complete. We do not accept materials outside of the SOPHAS process. The University of Maryland requires a Supplemental Application and a Supplemental Application Fee of $75 for each program.
> The application deadline for the MPH program is March 1. Applications are accepted for fall semester matriculation only (so spring semester admissions).

Degree Requirements

Master of Public Health--Physical Activity (M.P.H.)
The Master of Public Health (MPH) degree with a concentration in Physical Activity is a 43-credit professional degree, administered by the Department of Kinesiology. All MPH students with concentration in Physical Activity will complete five public health core courses, eight courses in the physical activity and related cognate area, an internship, and a capstone project.

Facilities and Special Resources

The Department of Kinesiology has three areas of specialization: Cognitive Motor Neuroscience, Exercise Physiology, and Physical Cultural Studies. Laboratories are maintained, which support original investigations in each of the three areas. Laboratories include equipment for measuring metabolic parameters, strength, body composition, postural sway, ground reaction forces, amount of physical activity in daily life, as well as muscle biopsies and movement analysis. The response of the human body to physical activity/exercise can be viewed through ECG, EEG, EMG and systematic behavior observation systems. Each of the three research areas has interfaced computer

Hatfield, Bradley D.
Hurley, Bernard F.
Iso-Ahola, Seppo E.
Roth, Stephen M.

Associate Professor
McDaniel, Stephen R.
Rogers, Marc A.
Shim, Jae Kun
Smith, J. Carson
Spangenburg, Espen

Assistant Professor
Chin, Eva
Gentilli, Rodolphe
Jette, Shannon
Miller, Ross H.

Research Assistant Professor
Dena Deglau

University Affiliate
Dena Deglau

hardware and software to support data collection and analysis. Collaborations with the School of Medicine at the Baltimore campus and with NIH often result in the availability of other facilities and equipment. All graduate students have access to computers and other forms of technology. Details and pictures of current facilities and equipment are available at our website: www.sph.umd.edu/KNES/.

Financial Assistance

Contact Information

Jennie Phillips, PhD, MPH Coordinator
2337 SPH Building, Dept. Kinesiology
University of Maryland, College Park
MD 20742
Telephone: 301-405-3056
jenniep@umd.edu

Courses: KNES

Public Policy: PhD Policy Studies (POSI)

Faculty:

Abstract

The School of Public Policy is one of the nation's leading graduate programs devoted to the study of public policy, management and international affairs, with particular expertise in the fields of environmental policy, international development, international security and economic policy, social policy, non-profit management, public management and leadership, and public finance. The School offers a wide variety of master's programs, joint degree programs, graduate certificate programs, and one of the nation's premier doctorate programs. The School's location just outside of Washington, D.C. attracts a stellar faculty of scholar-practitioners who are experts in the theory and practice of public policy and management and influential participants in the nation's policy-making process. The location and faculty in turn attract outstanding students by providing them, not only an in-depth, rich curriculum, but extensive exposure to and interaction with the real-life world of policy-making, the federal government, the international diplomatic community, state and local governments, and a host of non-governmental and multinational organizations. It is one of the few policy schools to combine state, national and international policy study under one roof, and to take into account policy interests in all sectors of the economy, thus allowing both faculty and students to study the full range of issues in all courses and in all research. The Ph.D. program trains policy analysts who will make their marks in the practice and teaching of public policy. To this end, a limited number of applicants are admitted annually. In their first year, students develop and demonstrate proficiency in economic, normative, political, and quantitative analysis. They then pursue advanced study within their chosen specialization. Finally, they complete and defend a doctoral dissertation. Those awarded the degree move on to public policy careers in government, research, academia, and the private sector.

Admissions Information

To apply to the School's PhD degree program, applicants must complete the University's online Graduate School Application. Please be sure to enter the correct four-letter program code: POSI

Application Deadlines

Application Requirements

1. GRE General required for PhD program
2. Statement of purpose

3. 3 Letters of Recommendation
4. All original transcripts
5. Resume
6. Statement of Research Interest
7. Writing Sample (must be submitted electronically)

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Ph.D. in Policy Studies program enables students to develop in-depth knowledge of the field and to conduct cutting-edge research on public policy and management issues. Students are required to complete at least 24 credits of appropriate coursework, including two required research methods courses. In addition, students must take 12 credits of dissertation research. Students are required to pass exams in the basic disciplines of public policy and two field exams, usually with both a written and oral component, in broad topics relevant to their proposed thesis topics. They then develop and defend a dissertation prospectus followed by the dissertation itself.

The Ph.D. in Policy Studies is principally directed at students who have a master's degree in public policy or a related field, such as economics, statistics, education or international relations, from a program comparable in quality and content to one of the School's own master's programs. Students may apply while in the final year of such a program. Applications will also be considered from recent college graduates without a master's degree who have an outstanding academic record.

Most students will be required to maintain full-time status through completion of the course work leading up to their exams and thesis proposal; this typically requires two to three years. Some students will be admitted on a part-time basis with an agreed schedule to ensure timely completion. A faculty member at the School must agree to serve as the Ph.D. applicant's academic sponsor at the time of admission into the program. To facilitate the selection of a sponsor, applicants should include, as part of their application, a description of the general areas in which they want to study and write their dissertation.

Financial Assistance

The School has financial aid available in the form of fellowships, graduate assistantships, and employment. All qualified applicants meeting appropriate deadlines are considered.

Contact Information

Office of Student Affairs
2101 Van Munching Hall
College Park, MD 20742
Telephone: 301-405-6331
Fax: 301-403-4675
policy-applications@umd.edu

http://www.publicpolicy.umd.edu

Courses: PUAF

Public Policy: Masters Programs (PUAF)

Faculty:

Abstract

The School of Public Policy is one of the nation's leading graduate programs devoted to the study of public policy, management and international affairs, with particular expertise in the fields of environmental policy, energy policy, international development,

international security and economic policy, health policy, education policy, social policy, non-profit management, public management and leadership,acquisitions, and public finance. The School offers a wide variety of master's programs, joint degree programs, graduate certificate programs, and one of the nation's premier doctorate programs. The School's location just outside of Washington, D.C. attracts a stellar faculty of scholar-practitioners who are experts in the theory and practice of public policy and management and influential participants in the nation's policy-making process. The location and faculty in turn attract outstanding students by providing them, not only an in-depth, rich curriculum, but extensive exposure to and interaction with the real-life world of policy-making, the federal government, the international diplomatic community, state and local governments, and a host of non-governmental and multinational organizations. It is one of the few policy schools to combine state, national and international policy study under one roof, and to take into account policy interests in all sectors of the economy, thus allowing both faculty and students to study the full range of issues in all courses and in all research.

Admissions Information

To apply to the School's Masters' degree programs, applicants must complete the online Graduate School Application. Please be sure to enter the correct four-letter program code:

- MAPO : Master of Public Policy (MPP)
- MAMG : Master of Public Management (MPM) - Policy Track
- EXPM : Executive Master of Public Management (EMPM)
- BMPO : Dual MPP and MBA
- LMPO : Dual MPP and JD
- PPCN : Dual MPP and MS in Conservation Biology
- MPPA : Master of Professional Studies in Public Administration

The admission processes for the School's dual BA/MPP program and its certificate programs are described on the School's website (www.publicpolicy.umd.edu). Students generally apply to the dual BA/MPP program near the end of their sophomore year at the University of Maryland. To be admitted to a graduate certificate program, students must first be admitted either to a degree program on campus or as an Advanced Special Student (discussed near beginning of catalog).

Application Deadlines

Application Requirements

1. GRE General OR GMAT required for all degree programs, except as noted below.
2. LSAT may be substituted for GRE General if applying to MPP/JD.
3. GRE General OR GMAT not required for Policy MPM or Executive MPM if Undergraduate GPA is at least 3.0
4. 3 Letters of Recommendation
5. All original transcripts
6. Statement of purpose
7. Resume

Degree Requirements

Master of Public Policy (MPP)
The MPP is a 48-credit, 16-course professional degree combining a rigorous curriculum with practical experience. All students take six courses that cover the primary tools of policy analysis: micro-economics, statistics, political analysis, moral dimensions, management and leadership, and either financial analysis or macro-economics. Students then specialize in one of the School's five primary areas of expertise: environmental

policy, international development, international security and economic policy, social policy, and management, finance, and leadership. Students then round out their coursework with either additional courses in their specialization, general policy/management electives, and/or a focus on non-profit management.

Most MPP students take 4 courses per semester and finish the program in two years. Students may instead take 1-4 courses each semester and complete the degree in two-five years.

Between the first and second year, and/or during the academic year, most full-time students engage in internships in international, federal, state or local government agencies, non-profit organizations, or private firms that are engaged in the policy process. In addition to offering practical experiences and the opportunity to further develop skills acquired during the first year, these internships provide students with contacts and relationships useful for future projects and job placement.

About 150 students from a wide variety of undergraduate schools and majors, from all parts of the country, and from around the world enter the program each fall. The mean undergraduate grade point average of entering students is 3.6 and GRE scores average in the low to mid 600s.

Public Policy/Management Graduate Certificates ()
The School of Public Policy offers several 12-18 credit graduate certificate programs for students in other degree programs on campus and professionals working in the policy arena who seek to enhance their understanding of policy analysis and management. See the School's website for available certificate programs and admission policies.

BA/MPP Dual Degree Program (MPP)
The dual BA/MPP program enables some of the better performing students pursuing an undergraduate major through the University's College of Behavioral and Social Sciences to earn both their BA and their master's degree in public policy in five years or less by counting up to 18 credits of their public policy graduate courses towards both degrees, thus significantly reducing both the time and cost of earning both degrees.

Most students apply to the program at the end of their sophomore year to be part of the program as of their junior year and to begin graduate courses in their senior year. For further discussion of admission and degree requirements, students may consult each school's website.

MPP/JD Dual Degree Program (MPP)
The University of Maryland School of Law (located in Baltimore) and the School of Public Policy offer a dual program of studies leading to both the MPP and JD degrees, in less time (often four years) and at less cost than if the degrees were obtained separately. Because they can double-count 9 credits taken at each school towards the other school, students complete 75 (versus 84) credits at the law school and 39 (versus 48) credits in the policy school, thus saving 18 credits.

Candidates must separately apply to the dual degree program in both the law school and the policy school. If admitted by only one program, the student may enroll in that program.

For further discussion of admission and degree requirements, students may consult each school's website.

MPP/MS in Conservation Biology (MPP)
As environmental problems become more scientifically and politically complex, employers and researchers in the environmental analysis and policy fields are increasingly looking to hire graduates who are well-grounded in the natural and life sciences, the workings of the public, private and non-government sectors, and the key policy analysis tools and concepts. The College of Computer, Mathematical and Natural

Sciences and the School of Public Policy offer a dual program of studies leading to both the MPP and the Master of Science in Sustainable Development & Conservation Biology in less time and at less cost than if the degrees were obtained separately. Because they can double-count some credits taken in one program towards the other program, students complete a total of 60 credits in the dual program versus 48 in the policy school and 39 in the M.S. program, thus saving 27 credits. Otherwise the requirements of both degree programs must be met.

Candidates must separately apply to the dual degree program in both the M.S. program and the policy school. If admitted by only one program, the student may enroll in that program.

For further discussion of admission and degree requirements, students may consult each school's website.

Executive Master of Public Management (EXPM or EMPM)
The Executive Master of Public Management (EMPM/EXPM) program is for professionals with at least 5 years of policy and/or management experience. It consists of 30 credits of prescribed courses in the arts of public management and policy analysis. Students move through the program as members of a cohort at a designated site, either off-campus or on-campus on alternating weekends (Friday evenings/Saturday days).

Additional information on the curriculum and admissions policies of this program is available on the School's website.

Master of Public Management - Policy Track (MPM)
The Master of Public Management (MPM) policy track is a 36 credit degree program for professionals with at least 5 years of policy and management experience. The program is identical to the MPP program except that students take four fewer general electives and may substitute a policy or management elective for the capstone course required in the MPP program.

Courses are offered throughout the day, but it is sometimes possible to complete the program by taking only courses beginning no earlier than 4:15pm. Students usually finish the program in three years by taking two courses each fall and spring semester, but can finish in as many as five years, or as few as one year by taking four courses in the fall and spring semesters, 1 during the winter semester, and 3 during the summer semester.

Master of Professional Studies in Public Administration (MPPA)
The Master's of Professional Studies in Public Administration (MPPA) program provides an in-depth education for students seeking professional careers in public administration. The MPPA requires the completion of 36 credit hours in the form of 12 specified courses in various aspects of public administration and policy. The program can be completed in either 16 months or 21 months. It is particularly appropriate for international students and uses numerous examples and case studies from around the world. It is cohort-based, with all students in a cohort taking the same courses. Please check the School's website to find out when the next cohort is expected to be formed.

Between the first and second year, and/or during the academic year, most students engage in internships in international, federal, state or local government agencies, non-profit organizations, or private firms that are engaged in public administration. In addition to offering practical experiences and the opportunity to further develop skills acquired during the first year, these internships provide students with contacts and relationships useful for future projects and job placement.

MPP/MBA Dual Degree Program (MPP)
The University of Maryland Robert H. Smith School of Business and the School of Public Policy (both located in Van Munching Hall) offer a dual program of studies leading to both the MPP and MBA degrees in less time (typically 5 or 6 semesters) and at less cost than if the degrees were obtained separately. Because some credits can be counted towards both degrees, students need only complete 42 (versus 54) credits in the business school

and 33 (versus 48) credits in the policy school, thus saving 27 credits. (Dual credit requirements subject to change.) Otherwise the requirements of both degree programs must be met.

Candidates must separately apply to the dual degree program in both the business school and the policy school. If admitted by only one program, the student may enroll in that program.

For further discussion of admission and degree requirements, students may consult each school's website.

Financial Assistance

The School has financial aid available in the form of fellowships, graduate assistantships, and employment. All qualified applicants meeting appropriate deadlines are considered.

Contact Information

Office of Student Affairs
2101 Van Munching Hall
College Park, MD 20742
Telephone: 301-405-6331
Fax: 301-403-4675
policy-applications@umd.edu

http://www.publicpolicy.umd.edu

Courses: PUAF

Real Estate Development (RDEV)

Faculty:

Applications will be reviewed on a rolling basis until the deadline. Applicants are STRONGLY encouraged to apply as early as possible. Recommendations, GRE/GMAT scores and TOEFL scores may be submitted after the application, but may delay review of an application.

Abstract

The Graduate Program leading to a Master of Real Estate Development is based in the School of Architecture, Planning & Preservation, but it is NOT a design degree. It was the 6th program in the country to offer a comprehensive business based, but multi-disciplinary, approach to real estate development education. There are now more than 20 of these programs offered across the US that recognize that real estate development in it's broadest and practical aspects is multi-disciplinary and benefits from weighing the financing and investment options in conjunction with consideration of the construction, design, planning and asset management of real estate. In sum -- Real Estate Development -- is all of the above. So if this intrigues you, read on.

The 33-42 credit MRED program stresses a comprehensive approach to real estate development, broadly defined, and encompasses traditional real estate finance topics but goes on to address the full range of development issues--from property acquisition, to planning and permitting, contract and property law, investment and finance, design and construction, as well as marketing, commercial leasing, property, portfolio and asset management. The program aims to assure that graduates can effectively engage lenders, investors, architects, contractors, lawyers, accountants, and public officials as well as how to bring a project in on time with dynamic marketing and efficient property management thereafter.

The program uses three key teaching/learning approaches: (1) the traditional graduate reading and research mode, (2) the popular case study review and discussion method, and (3) the studio, or practice method, engaging the professional development community as partners in class and in the field to enliven the concepts presented in the classroom lecture and discussion. Most of the instructors for the program are active professionals in the real estate field. Graduates are also prepared to enter the real estate industry with important skills in business writing, presentation, leadership and negotiation as well as a keen awareness of the MRED Quadruple Bottom Line and ability to develop real estate properties that are: Economically Viable, Environmentally Respectful, Socially Responsible and Beautifully Designed.

The sequence of courses and number of semesters to complete the program can be tailored to the academic preparation and any work experience of each student. There is no requirement for work experience. Students may elect an: Accelerated Path--12 months (for students with finance education or experience); Full time path--15-18 months (for students not working more than 10 hours a week); or Part Time path--24-60 months (for students working 20 hours or more a week). The program admits up to 30 new students in each of the Fall (late August) and Spring (late January) terms. Students have up to 5 years to complete all their course work, although the average time for part time students is 24 months, 18 months for full time students.

All real estate (RDEV) courses are offered in the evenings on one night a week, with courses scheduled Mondays through Fridays in the Spring and Fall terms. Some courses are delivered in executive-style workshop format over long weekends. Limited courses are offered evenings in Summer and Fall on more intensive schedules. Electives in other programs may be scheduled late afternoon or on multiple days. Students may use one elective course to take a study abroad course offered by any of the programs in the School. Additional reduced fee courses in desirable skills are periodically offered through the Institute, such as Preparation for the LEED exams, ARGUS, Co-Star and REFM Financial Modeling

While the program is quite flexible, there are some restrictions to consider. Students who are working full time are not permitted to take more than two courses in any one semester. Course offerings in the Winter and Summer term are very limited, and students may not enroll in more than one in Winter and two in Summer. Scholarship funds are not available for Winter, Summer and Study Abroad courses. Students desiring to follow the accelerated path (4 courses per term) need to request early advising and plan their course sequence carefully and may not be working even part time. Completion of the degree in 12 months is only guaranteed to be available for students starting in the Fall term and only for those who have some real estate finance education or experience.

Admissions Information

Acceptance to the program is on a competitive basis. Applicants are required to have a minimum undergraduate grade point average (GPA) of 3.0 on a 4.0 scale from an accredited University. Applicants who demonstrate a strong interest and aptitude with a GPA below 3.0 may be considered based on recommendations or proven success in the field. Such applicants are admitted provisionally and may be conditional on additional course work.

Applicants for the MRED program are required to submit a GRE/GMAT/LSAT score, unless they are 5 or more years beyond the granting of their undergraduate degree.

Applications are also accepted from students completing the Graduate Certificate of Professional Studies in Real Estate Development with up to four GCPS courses applied to the MRED degree.

There are no requirements for an applicant's previous field of study or experience, and diverse applicants, from all academic backgrounds, are very welcome. Students with no economics, real estate finance or accounting background will be admitted conditionally on taking 1 to 4 leveling courses (1 - 9 credits) as part of the degree, in which case the

credits to obtain the MRED degree may be 34 - 42 credits. Students may, prior to admission, take an entry level accounting course from an accredited institution other than the University.

Application Deadlines

Fall:
Applications for Fall 2013 for the RDEV or Real Estate Certificate must be received by March 15 for Domestic Applicants and by January 1st for International Applicants. March 15 (**February 1 preferred**) .
Spring:
Applications for the Master's of Real Estate Development and Certificate of Real Estate Development for Spring 2012 must be received by October 1 for Domestic Applicants and June 1 for International Applicants October 1 (**September 1 preferred**) .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Statement of Purpose - specific to interest in dual degree
2. Graduate Record Examination (GRE), Graduate Management Admission Test (GMAT, or Law School Admissions Test (LSAT) (for those less than 5 years from earning their undergraduate degree)
3. Transcript(s)
4. Letters of Recommendation (3)
5. CV/Resume
6. TOEFL/IELTS/PTE (international applicants only)

Degree Requirements

Master of Real Estate Development (MRED)
MRED is a 33-42 credit hour professional masters degree in real estate development. The curriculum has 8 core requirements, 3 electives including a required capstone course integrating knowledge from all parts of the curriculum. There are 3 core required courses in Development Law, Fundamentals of Finance and the Capstone final course. There are 5 cognate areas from which a course must be taken to fulfill degree requirements: Planning and Entitlements, Negotiations/Leadership Soft Skills, Urban Design, Construction Management, and Asset and Portfolio Management.

Electives may be selected in focus areas of: Advanced Finance, Sustainability, Affordable Housing, Historic Preservation and Urban Planning. Electives may also be taken in any of the cognate areas of Construction, Design, Valuation, and Asset Management.

Applicants without education or work experience in real estate, particularly real estate finance, accounting or valuation, are admitted subject to adding 1 to 9 credits of additional RDEV course work in the first or second term of their MRED degree program. Students with no background can expect to be subject to the full 9 credits; most applicants have 6 - 9 additional credits to complete.

Admitted Students are required to attend a 2-day Assessment and Orientation Program (Friday night through Sunday afternoon) prior to their first semester of taking RDEV courses.

Students may be required, based on the introductory Assessment sessions or subsequent classwork, to take additional evening or weekend coaching courses/sessions in Excel Skills, Business Writing or Oral Presentation. Successful completion of all supplemental coaching sessions is required for graduation.

Graduates must achieve a 3.0 GPA overall based on all coursework; prepare a final capstone project or research thesis; and publicly present their capstone work to a jury in order to be awarded the MRED degree.

Students must meet minimum professional writing and presentation standards, and complete successfully all excel, business writing, and oral presentation and skills non-credit courses or coaching as are offered and required during the period of enrollment. These courses may incur an additional charge paid to the Colvin Institute.

International Students also must test out or successfully complete within two semesters the University English writing courses as determined by the Office of International Student and Scholar Services (ISSS).

The MRED program is highly flexible which allows for tailoring the required core and cognate courses to a student's background and interest, such that a student with a strong background in architecture, law, planning, public policy or finance, could substitute out of the core/cognate course in their area of expertise and add a more advanced course or an unrelated RDEV elective with the advice and approval of the Director. The course work for the core courses is very intense, and off site visits are required in most courses anywhere from 1 to 3 times per semester some of which are scheduled for weekend hours, and some during working hours in limited instances.

Limited Courses are offered during Summer and Winter terms. Students may take no more than two courses over the Summer terms and one course in Winter term. The maximum number of credits toward the MRED degree that may be taken in Summer/Winter terms is twelve (12). One course (no more than 3 credits) may be credited toward the MRED degree for program approved Study Abroad courses. See the Program Director for details before applying for any Study Abroad course. Certificate students are subject to the same requirements as above, but may not take elective or advanced courses or apply a Study Abroad course to the certificate.

Facilities and Special Resources

The University of Maryland is an exceptional location for the pursuit of graduate studies in the field of real estate development, and graduate students are encouraged to take advantage of the opportunities. The University is eight miles from the incomparable library and research facilities of Washington, D.C. In the nation's capital, MRED graduate students have access to the Library of Congress, as well as the specialized collections of professional associations and international organizations, such as the National Association of Home Builders, the Urban Land Institute, the American Institute of Architects, the National Building Museum. Access to agencies at all levels of government--municipal, county and state--which regulate various aspects of real estate are all available and engaged with the program.

Close by the University are key historically important and interesting places in the development of U.S. communities, including the 4th settlement in America at Historic St. Mary's City in Southern Maryland, which was the first planned city in America. Just 10 minutes from campus is the 1930s iconic new town (coop) of Greenbelt, Maryland, and within 45 minutes are the 1960's new towns of Columbia, Maryland, St. Charles, Maryland and Reston, Virginia. One of the best examples of new urbanism is the Kentlands development less than 30 minutes away in Gaithersburg, MD. And not to be missed are the major redevelopment and urban living revivals in the Port City of Baltimore and the historic neighborhoods of Anacostia and Columbia Heights in the District of Columbia, as well as the suburbs that are reinventing themselves in the close in suburbs to the District in Northern Virginia and Maryland.

The program is also the home of the Colvin Institute of Real Estate Development, endowed by John and Karen Colvin, key supporters of the MRED program. The Institute support the outreach to the industry through a Council of Advisors, the production of a real estate journal with the Director as Editor-in-Chief -- the Real Estate Review, as well as various networking and high profile real estate events on and off campus. Also associated with the School is the National Center for Smart Growth Research and Education, which involves faculty and graduate students from several campus units in multi-disciplinary research on the fiscal, environmental and social impacts of alternative development patterns; evaluation of growth management strategies, transportation

patterns and planning therefor, as well as technical assistance to state agencies and local jurisdictions.

The program's location in College Park, Maryland, with direct Metro access to downtown Washington, D.C. and easy access up the Baltimore-Washington Parkway to Baltimore City, makes field work, site visits and interaction with ongoing real estate developments and developers one of the signature features of the MRED program.

The MRED Council of Advisors, as well as adjunct faculty who are active professionals in all aspects of real estate development, are eager to engage with students in the program which offers formal and informal occasions for advice about the current trends in the industry as well as the possibility of full- or part- time employment or internships.

There is both an active Student real estate club, SoRED, but also a very strong MRED alumni group in the area who meet quarterly and are very effective in helping each other find positions as well as work with each other now they are out in the field. Announcements about full time and intern positions are posted to the MRED list serve frequently. Adjunct faculty and guest speakers are generally very willing to help students network and connect with employment resources once they have completed their core courses. The School also has a placement officer who is available by appointment to help students in their search.

Financial Assistance

The Program provides scholarship funds to a number of qualified students, both part time and full time, each term. Scholarship determinations are made at the time of application and admission. Scholarships are generally awarded on a per course basis and commitments are made at the time of admission and apply to the entire program (other than Study Abroad, Summer and Winter courses), subject to academic performance.

The Colvin Institute offers a limited number of administrative positions to full time MRED students. Contact the Program Director to apply.

Periodically there are named scholarships provided by various real estate organizations or development companies.

In addition, there are work opportunities both on, and off campus, and they are relatively plentiful. Students in the past have been successful in finding part time internships and full time work with local real estate companies. The MRED student listserv posts openings periodically as they are brought to the attention of the Program by alumni, friends, faculty and sponsors.

Applicants should inquire as to the availability of funding for the term they are starting. Scholarships are typically for a portion of tuition only, and are paid on a per course basis as a student progresses through the program. Scholarships are available to part time, full time, and accelerated students.

If tuition costs are a major factor in your choice of real estate program, please contact us about financing possibilities. The total cost of the MRED degree is the most competitive in the region, as well as around the country, with a cost-benefit ratio that is unparalleled. There are also significant University and Colvin Institute resources available for student enrichment activities such as support for competitions, site visits, and attendance at local, regional and national real estate events.

Contact Information

To arrange a visit, phone interview, or for more information, please contact the Program Director, Margaret McFarland, at mmcf@umd.edu. Additional information on case competitions, samples of student work, as well as syllabi and adjunct faculty bios can be

found at the MRED Program's Web site (http://arch.umd.edu/rdev/real-estate-development) and the Colvin Institute site at www.colvininstitute.org. For information about our industry supporters and the Real Estate Review and Colvin Institute activities go to www.colvininstitute.org. You will also find the Colvin Institute providing outreach and information at the ICSC in Las Vegas each May, at the ULI National Conference each October, and at many local events of Bisnow, ICSC, ULI, CREW, AAREP, and HAND.

Margaret McFarland, JD, Clinical Professor & Director, Graduate Programs in Real Estate Development
University of Maryland School of Architecture, Planning and Preservation Building 145
College Park
MD 20742
Telephone: 301-405-8000
mmcf@umd.edu

http://arch.umd.edu/rdev/real-estate-development

Courses: RDEV ARCH HISP URSP ECON PUAF CCJS

Related Programs and Campus Units

Architecture
Business and Management
Historic Preservation
Landscape Architecture
Urban and Regional Planning and Design
Urban Studies and Planning

Russian Language and Literature (RUSS)

Faculty:

Abstract

The M.A. in Russian Language and Literature (RUSS) has been transformed into the M.A. in Second Language Acquisition and Application (SLAA) Degree Concentration: Russian for Special Purposes.

This degree is intended for individuals who require advanced-level academic and practical training in Russian beyond the B.A. degree so that they may acquire high-levels of linguistic and cultural competence for use of Russian in the professional workplace. It meets the academic needs of the people already working or seeking careers in government, education, private industry or non-profit organizations.

For all the further information concerning the program description, the faculty and the admissions process, go to the Second Language Acquisition and Application (SLNG) Program in the Graduate Catalog and visit the website at:

http://www.languages.umd.edu/SLAA

Please note that the application code for the Russian for Special Purposes Program is SLRU.

Admissions Information

In addition to the Graduate School requirements, candidates should have a bachelor's degree with a major in Russian Language and Literature, Russian Language and Linguistics or the equivalent with a fluency in the written and spoken language.

Application Deadlines

Application Requirements

Degree Requirements

Facilities and Special Resources

In addition to the course offerings listed below, the Russian section of the Department of Asian and East European Languages and Cultures participates as an institutional partner in language study and research programs in Russia, the other New Independent States, and Eastern Europe, sponsored by the American Council of Teachers of Russian (ACTR/ACCELS). ACTR contributes to the support of University of Maryland, College Park students abroad as well as to visiting faculty and curriculum consultants from the NIS at Maryland.

The Russian Section also sponsors the Russian Club, the University of Maryland Chapter of Dobro Slovo (the National Russian Language Honor Society), and a Russian residential program within the International Language House, St. Mary's Hall.

Distinguished scholars and lecturers, as well as visiting professors, visit the metropolitan area and campus regularly. College Park's proximity to Washington D.C., facilitates participation in the many cultural functions of the capital as well as access to research facilities such as The Kennan Institute for Advanced Russian Studies and the Library of Congress.

Financial Assistance

The Russian section offers graduate teaching assistantships, and the Graduate School offers, on a competitive basis, various fellowships and grants.

Contact Information

For further information, write to:

Dr. Maria Lekic
3215 Jimenez Hall
Department of Asian and East European Languages and Cultures
MD 20742
Telephone: (301) 405-4099
Fax: (301) 314-9752
lekic@actr.org

Website: http://www.languages.umd.edu/AsianEastEuropean/russian/

Courses: RUSS SLAV

Second Language Acquisition-MA & Certificate (SLMA)

Faculty:

Professor
DeKeyser, Robert
Doughty, Catherine J.
Long, Michael H.
Ross, Steven J.

Associate Professor
Gor, Kira
Jiang, Nan

Abstract

The M.A. is intended primarily as a two-year program for full-time students. A very limited number of part-time students would also be admitted. It will provide students with rigorous, comprehensive training in the theory and research of second (including foreign) language learning, teaching and testing, and related areas. A major program focus

includes preparation for those working, or intending to work, in programs for tertiary students and adults studying less commonly taught languages (LCTLs), e.g., East-Asian and Middle-Eastern languages, and such modern European languages as Spanish, French, Italian and German. Areas of particular faculty expertise include cognitive processes in SLA; language teaching methodology and pedagogy; psycholinguistics; language processing; individual differences in such factors as age, aptitude, and working memory; second language analysis; interlanguage studies; heritage learners; needs analysis; syllabus design; materials writing; learner training; language assessment; program evaluation; second language research methods; task-based language teaching; and uses of technology in language learning and testing.

Admissions Information

Application Deadlines

Application Requirements

Students may enter the program in the Fall semester only. Prior to admission to the program, applicants must have successfully completed a Bachelors degree from an accredited university in a relevant field, e.g., linguistics, applied linguistics, psychology, foreign languages, applied linguistics, cognitive science, anthropology or education. They must provide three letters of recommendation from academic and/or professional referees. They must submit a statement of purpose describing their academic and career background and future plans, specifying why they believe the UMCP program is suitable for them, and they for it, and how they would expect to use the training received. Unless they completed a prior degree at an English-medium university within the previous three years, students whose native language is not English must provide a TOEFL score of 600 or higher on the paper-based version (250 or higher on the computer-based version; 100 on the internet version) or an IELTS score of 8. The TOEFL or IELTS must have been taken within the last two years for the scores to be valid. Verbal and quantitative GRE scores will be required of all native speakers of English, and are recommended for non-native speakers, as well.

Degree Requirements

Master of Arts (M.A.)
The M.A. in SLA is a 30-credit program, with two tracks: Plan A, by coursework and thesis, and Plan B, by coursework only. These two tracks are meant to accommodate two slightly different populations, those planning on going on for the Ph.D. at Maryland or elsewhere (Plan A) and those who will be consumers and interpreters rather than producers of research and for whom the M.A. will be a terminal degree (Plan B). A Certificate in SLA will also be offered. The Certificate requires 18 credit hours of course work from the Plan B curriculum.

Plan A: Coursework and thesis-
Six required core courses (18 credits), all taught in English
1. SLAA 610: Introduction to SLA
2. SLAA 611: Fundamentals of Language Acquisition and Instruction
3. SLAA 630: Second Language Testing
4. SLAA 640: Psycholinguistics
5. SLAA 650: Second Language Analysis
6. SLAA 620: Second Language Research Methodologies

Two electives (6 credits) to include any SLA course, or a course chosen from offerings in another department. All electives will be chosen in consultation with and with the approval of the program advisor.
7. Elective 1
8. Elective 2

Thesis (6 credits)

Plan B: Coursework only-
Five required core courses (15 credits), all taught in English
1. SLAA 610: Introduction to SLA
2. SLAA 611: Fundamentals of Language Acquisition and Instruction
3. SLAA 630: Second Language Testing
4. SLAA 640: Psycholinguistics
5. SLAA 650: Second Language Analysis

Five electives (15 credits), any appropriate combination of SLAA courses and courses in other departments. All electives will be chosen in consultation with and with the approval of the program advisor.
6. Elective 1
7. Elective 2
8. Elective 3
9. Elective 4
10. Elective 5

Certificate in SLA:
Five required core courses (15 credits), all taught in English
1. SLAA 610: Introduction to SLA
2. SLAA 611: Fundamentals of Language Acquisition and Instruction
3. SLAA 630: Second Language Testing
4. SLAA 640: Psycholinguistics
5. SLAA 650: Second Language Analysis

One elective (3 credits), any appropriate combination of SLAA courses and courses in other departments. All electives will be chosen in consultation with and with the approval of the program advisor.
6. Elective 1

Facilities and Special Resources

In addition to the University graduate library, the SLA program offers research facilities and resources to facilitate research and materials development, including a multimedia SLA Lab, the Language House, The Center for Innovative Teaching and Learning, the Office of Information Technology, and the Center for Teaching Excellence.

Students completing coursework with affiliate faculty in the Departments of Psychology, Communication, Linguistics, and Education as well as the Center for Advanced Study of Languages may have access to their respective resources.

Financial Assistance

Masters Degree and Certificate students in the College of Arts and Humanities are rarely offered funding. It is expected that students admitted to the SLA M.A. or Certificate Program will come with outside sponsorship.

Contact Information

The SLAA Web site offers more information about the program. For further inquiries, please contact Dr. Steven J. Ross, Graduate Director, at sla-info@umd.edu or sross@umd.edu (Tel: (301) 405 4246). Alternatively, if you have particular interest in the research of individual faculty members, you are welcome to contact them by email.

Dr. Steven J. Ross, Director, SLA Program
School of Languages, Literatures, and Cultures 3215 Jimenez Hall, University of Maryland, College Park

MD 20742
Telephone: 301 405 4246
Fax: 301 314 9752
sross@umd.edu

http://www.languages.umd.edu/SLAA

Courses: SLAA PSYC EDMS HESP EDHD LING COMM EDCI PHIL

Related Programs and Campus Units

Speech-Language Pathology

Second Language Acquisition-Ph.D. (SLPH)

Abstract

The Ph.D. program in SLA at the University of Maryland aims to train students to conduct research on second language acquisition processes. It has a strong cognitive focus. The program draws upon the expertise of a distinguished cadre of faculty in the School of Languages, Literatures and Cultures, and in affiliate departments such as Human Development, Linguistics; Measurement, Statistics, and Evaluation; Hearing and Speech; Philosophy; Psychology; and Curriculum and Instruction.

Admissions Information

Application Deadlines

Fall:
Applications must be received by January 15 .
Spring:
Applications from US residents/citizens must be received by September 15 .
Applications from non-US residents/citizens must be received by June 1 .

Application Requirements

1. M.A. or M.S. degree in related field such as SLA, linguistics, psychology, or applied linguistics.
2. Three Letters of Recommendation.
3. Statement of Purpose in English. [Note that this single statement replaces the statements listed on the Graduate School application: "Statement of Goals and Research Interests" and "Statement of Experiences."]
4. Verbal and Quantitative GRE scores are required for all applicants
5. iBT TOEFL score of 105, or TOEFL PBT 620 or higher for non-native speakers of English
6. Writing sample demonstrating evidence of ability and interest in undertaking scholarly research; could be published paper or M.A. thesis.
7. An interview may be required, in person or by phone.

For more information, consult the program's web site.

Degree Requirements

Doctor of Philosophy (Ph.D.)
The Ph.D. has 4 areas of specialization: **Second Language Learning, Second Language Instruction, Second Language Measurement and Assessment**, and **Second Language Use**. Students select 2 courses each from 2 of these areas (for a total of 4 courses) and are expected to take 2 additional electives in the area of their proposed dissertation work. In addition, all students are expected to take 2 courses in quantitative and/or qualitative research methods. The 8 courses (total) represent the

Faculty:

Director
Ross, Steven J.

Professor
DeKeyser, Robert
Long, Michael H.

Associate Professor
Gor, Kira
Jiang, Nan
Moyer, Alene

Research Scientist
Doughty, Catherine J.
Zukowski, Andrea

Affiliate Professor
Carruthers, Peter
Idsardi, William
Lidz, Jeffrey
Lissitz, Robert W.
Phillips, Colin
Ratner, Nan Bernstein

Affiliate Associate Professor
Moyer, Alene
Newman, Rochelle
Scullen, Mary Ellen

minimum coursework requirement. Some students may need remedial coursework prior to undertaking their 8 courses, and many will wish to take courses beyond the minimum 8 based on their interests. Additionally, all students are strongly encouraged to take a course in the philosophy of science. Before graduation, all students completing the PhD in Second Language Acquisition must demonstrate three types of experience with non-native language: learning a non-native language, using a non-native language, and teaching a language to non-native speakers of that language. All three types of experience will be verified through official documentation and/or assessment as follows:

1. Language Learning. Students must have spent at least two semesters as a student of a non-native language in a post-secondary classroom environment (6 total credits minimum). Verified through transcript. SLLC will provide this experience for any student who needs it.

2. Language Teaching. Students must have taught a language to non-native speakers of that language for at least 1 semester, or the equivalent of 45 hours. Verified through contract, letter, etc. SLLC will provide this experience for any student who needs it.

3. Language use. Students must show that they are able to communicate in a non-native language at the intermediate-low level on the ACTFL scale through an Oral Proficiency Interview (OPI). Students whose native language is not English will be able to satisfy this requirement through their competency in English. These three requirements do not necessarily have to be met in the same language. Before the PhD dissertation, two qualifying papers are required. Please see the program website for more details.

Facilities and Special Resources

In addition to the University graduate library, the SLA program offers research facilities and resources to facilitate research and materials development, including a multimedia SLA Lab, the Language House, The Center for Innovative Teaching and Learning, the Office of Information Technology, and the Center for Teaching Excellence.

Students completing coursework with affiliate faculty in the Departments of Psychology, Communication, Linguistics, and Education as well as the Center for Advanced Study of Languages may have access to their respective resources.

Financial Assistance

Most students admitted to the Ph.D. program will be funded, either via graduate or teaching assistantships or via research assistantship on grants and contracts, all providing tuition waiver plus stipend. Some students may receive a Graduate Assistantship from the UMCP-affiliated Center for the Advanced Study of Language (CASL) or the National Foreign Language Center (NFLC, a unit within the College of Arts and Humanities (ARHU).

Contact Information

The SLAA web site offers more information on the program. For further questions, please contact Dr. Steven J. Ross, Graduate Director of the program, at sla-info@umd.edu or at (301) 405-4246. Alternatively, if you have a particular interest in the research of an individual faculty member, you are welcome to contact that person directly via email.

Dr. Steven Ross Professor & Graduate Director
Second Language Acquisition Program University of Maryland 2103 Jimenez Hall

MD 20742
Telephone: 301-405-4246
Fax: 301-314-9752
sross@umd.edu

http://www.languages.umd.edu/SLAA

Courses: SLAA PSYC EDMS EDHD COMM EDCI LING PHIL HESP

Related Programs and Campus Units

Linguistics
Speech-Language Pathology

Sociology (SOCY)

Abstract

The Graduate Program in Sociology is designed for students seeking a Ph.D. degree. However, the M.A. option is available to students who either wish to obtain a master's degree while continuing in the Ph.D. program, or who leave the program before finishing the PhD. Areas of emphasis in the Department include: demography; development; gender, work, and family; globalizing theory; military sociology; social psychology; and stratification.

Typically, about half the students finishing Ph.D. degrees in the Sociology Department work as faculty members at colleges and universities, and about half are working in research, administration, and consulting in federal, state, or private organizations. Our location in the Washington, D.C., area offers an unusual number of full-time research opportunities for our graduates.

Admissions Information

Admission to the graduate program is based upon the student's academic record, GRE scores, letters of recommendation, and other information relevant to the applicant's chances of being successful in the program. Although a previous major in Sociology is not required, students entering the graduate program should have had the following in undergraduate courses: mathematics through college algebra, elementary statistics, sociological theory, and sociological research methods. Students who have completed prior graduate coursework in Sociology may petition to waive one or more courses in Social Theory, Statistics, or Research Methods. New graduate students are assigned temporary advisors upon arrival, and are then expected to select a permanent advisor who will direct their dissertation research. For consideration for departmental fellowships or assistantships, applications should be received by the preferred deadlines.

Application Deadlines

Fall:
February 15 (**January 3 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE (Verbal, Quantitative, and Analytical Writing)
2. TOEFL required for all international students
3. Statement of Goals, experiences and research interests
4. Three Letters of Recommendation
5. Writing Sample
6. Transcripts (undergraduate and graduate)

Faculty:

Chair
Korzeniewicz, Roberto P.

Associate Chair
Pease, John

Graduate Director
Sayer, Liana

Distinguished University Professor
Collins, Patricia Hill
Presser, Harriet B.
Presser, Stanley
Ritzer, George

Professor
Chen, Feinian
Cohen, Philip
Desai, Sonalde B.
Finsterbusch, Kurt
Fisher, Dana
Korzeniewicz, Roberto P.
Lucas, Jeffrey
Rendall, Michael
Ritzer, George
Sayer, Liana
Vanneman, Reeve D.
Villarreal, Andres
Yu, Wei-Hsin

Associate Professor
Kahn, Joan R.
Kestnbaum, Meyer
Kleykamp, Meredith
Marsh, Kris
Neustadtl, Alan
Pease, John

Assistant Professor
Park, Julie
Prell, Christina

Research Professor
Bachrach, Christine
Das Gupta, Monica

Affiliate Professor
Dill, Bonnie T.
Hofferth, Sandra L.
Lafree, Gary D.
Laub, John H.

Degree Requirements

Doctor of Philosophy (Ph.D.)
Ph.D. requirements include: 1) two courses in social theory (6 cr.); 2) two courses in statistics (6 cr.); 3) two courses in research methods (6 cr.); 4) an advanced statistics course approved by the student's advisor OR an additional course in research methods (3 cr.); 5) one computer skills course (1 cr.); 6) one course in proposal development (3 cr.); 7) a set of three courses in each of two specialty areas (independent reading courses do not count) (18 cr.); 8) a second-year research paper which meets the approval of a minimum of two faculty members (3 cr.); 9) a second-year research paper which meets the approval of two faculty members (completed while enrolled in 3 credits of SOCY699) 10) 12 credit hours of dissertation research (12 cr.); and 11) a total of 58 credit hours of coursework and research.

After completion of the coursework, doctoral students must pass two examinations qualifying them to write their dissertations in the specialties of their choice. Upon the recommendation of the appropriate faculty members, the Department Graduate Committee approves the coursework qualifying students to take the two examinations.

Master of Arts (M.A.)
The graduate program in the Department of Sociology is designed for Ph.D. students. We do not offer a terminal Masters program and we will not accept or enroll students for the single purpose of acquiring a Masters degree. However, doctoral students may obtain a Master of Arts degree during their course of doctoral study by completing 30 credit hours, including 1) two courses in statistics (6 cr.); 2) one in methodology (3 cr.); 3) one in theory (3 cr.); 4) one computer skills course (1 cr.); 5) one course in proposal development (3 cr.); 6) an original research paper completed in the fourth semester (3 cr.).

Facilities and Special Resources

In addition to these programs, the department is closely involved with the following research centers: the Center for Research on Military Organization, the Maryland Population Research Center (MPRC), the Center for Innovation, and the Program for Society and the Environment. Collectively, these centers account for over five million dollars in annual research funding. The Department is also affiliated with an interdisciplinary Joint Program on Survey Methods (JPSM). The campus has excellent computer facilities and computer resources are available to faculty and graduate students.

Financial Assistance

Financial assistance for graduate students is available through teaching and research assistantships, and for advanced students through part-time instructorships. We also have several special fellowships for outstanding applicants that provide additional support tailored to the applicants needs. All carry a stipend plus tuition remission, and most include health benefits.

Contact Information

Applications materials may be found at:
http://www.gradschool.umd.edu/gss/admission.htm

All application materials should be submitted either electronically or by mail to this address: University of Maryland College Park Enrollment Services Operations (ESO) Applications for Graduate Admission Room 0130 Mitchell Building College Park, MD 20742

Wilson, Laura B.
Zambrana, Ruth Enid

Affiliate Associate Professor
Andrews, David L.
Kleykamp, Meredith
Madhavan, Sangeetha

Affiliate Assistant Professor
Dinwiddie, Gniesha

Lecturer
Moghadam, Linda L.

Professor Emerita
Meeker, Barbara F.
Milkie, Melissa A.
Segal, David R.
Segal, Mady W.

Professor Emeritus
Clignet, Remi
Dager, Edward Z.
Falk, William W.
Hage, Jerald
Kammeyer, Kenneth C.W.
Landry, L. Bartholomew
Robinson, John P.

Associate Professor Emerita
Hunt, Janet G.

Associate Professor Emeritus
Hunt, Larry L.
Lengermann, Joseph J.

Liana Sayer, Director of Graduate Studies
2112 Art-Sociology Building
College Park, MD 20742-1315
Telephone: (301) 405-6390
Fax: (301) 314-6892
gradsoc@umd.edu

http://www.bsos.umd.edu/socy/

Milton Costen, Graduate Coordinator
2112 Art-Sociology Building
College Park, MD 20742-1315
Telephone: (301) 405-6390
Fax: (301) 314-6892
gradsoc@umd.edu

http://www.bsos.umd.edu/socy

Courses: SOCY

Related Programs and Campus Units

Family Science

Spanish and Portuguese Languages and Literatures (SPAP)

Abstract

The Faculty of the Department of Spanish and Portuguese is committed to excellence in teaching and mentoring, along with the production of new knowledge that is the hallmark of a strong department. We are known for our focus on intersections between language, literature, culture, and politics, our community engagement, and our MA track in Hispanic Applied Linguistics. We bridge several intellectual fields across Spain and Spanish America and between North, Central and South America, the Caribbean, and Brazil, as we rethink the specificity of our cultures. The Department has been the home of major Latin American and Spanish literary figures, to include Juan Ramón Jiménez, who taught at the University between 1943 and 1951 and who, after being nominated by the Department, received the Nobel Prize for Literature in 1956. His legacy, as well as that of cultural critic Ángel Rama, award-winning poet José Emilio Pacheco, and Professor Emerita Graciela Palau de Nemes, among others, continues to shape our thought, vision, and mission.

The Department is renowned for its interdisciplinary strengths in Latin American and Lusophone literatures and cultures as well as its faculty research in the areas of the history of ideas, Southern Cone literature, Judeo-Latin American literature, Mexican literature, theater, and performance, Latin American modernismo, colonial and transatlantic discourses, Central American transnational cultures, U.S. Latinidades, Quechua language and indigenous literatures, Caribbean poetics, salsa and sabor, Brazilian cinema, Lusophone Africa and African diaspora studies, deconstructions of the Cuban Revolution, and contemporary reinscriptions of the nineteenth century.

Faculty members in the area of Spanish literature are recognized for their work in the history of the Spanish language and philology from the Middle Ages to the present, Medieval historiography and women narratives, Golden Age poetics, Cervantes and Quevedo traditions, revisions of the Enlightenment, romanticism (journalism and costumbrismo) and realism (philosophical traditions), modern and postmodern narrative

Faculty:

Graduate Director
Long, Ryan F.

Head
Merediz, Eyda

Professor
Benito-Vessels, Carmen
Igel, Regina
Quintero-Herencia, Juan Carlos
Sosnowski, Saul

Associate Professor
Demaria, Laura
Lacorte, Jose Manuel
Lavine, Roberta Z.
Long, Ryan F.
Merediz, Eyda
Naharro-Calderon, Jose M.
Penrose, Mehl
Rodriguez, Ana Patricia
Sanchez Martinez de Pinillos, Hernan

Assistant Professor
Leal-Lima, Thayse

Distinguished University Professor Emeritus
Aguilar-Mora, Jorge

Professor Emerita
Cypess, Sandra M.
Harrison, Regina
Nemes, Graciela P.

and poetics, as well as representations of the Spanish Civil War and exile, particularly in Latin America.

The Department is also at the forefront of Spanish Applied Linguistics, language teaching pedagogy, language teacher education, language use and identity, social and political issues in foreign language teaching and learning, instructional technology, learner variables and learning disabilities, language for specific purposes, cross-cultural communication, and heritage language learning.

Mission

The Department of Spanish and Portuguese seeks to forge a strong dialogue between, and within, our areas of specialization pertaining to Latin America, Spain, and Portugal. To that end, we offer thorough instruction in the diverse, complex, and globalized literatures, cultures, and linguistics of the Spanish and Portuguese-speaking world. Our students not only develop the critical language skills to communicate in the target language but also gain an understanding of the cultures, politics, histories, and literatures of the communities and national spaces of the Americas, Spain and Portugal.

Our goal is to foster learning, develop critical perspectives, and promote intellectual growth in our students. We teach across interdisciplinary fields such as literature, film, popular and visual culture, theatre, history, philosophy, critical theory, gender and queer studies, philology, and linguistics in different cultural and geographic contexts. We strive for the creation and discussion of new forms of knowledge and the effective engagement of our students and faculty with the world. We prepare students to become promising professionals in their chosen careers.

Our M.A. and Ph.D. graduates are mentored by our faculty, engage in substantive research projects, and benefit from rigorous training in the teaching skills required by the profession. They are prepared to meet the professional demands of highly competitive academic positions in the United States and Latin America.

Admissions Information

In addition to Graduate School requirements, candidates must have a bachelor's degree with a major in Spanish Language and Literature, or the equivalent in a related field with near native fluency in the written and spoken language.

Application Deadlines

Fall:
Applications must be received by JANUARY 7 to be considered for admission. This deadline applies to both, national and international students. January 7 (**January 7 preferred**) .

Application Requirements

- 1. Official Transcripts (minimum 12 credits upper level literature/culture courses)
- 2. TOEFL (minimum required 575) or IES* results for foreign students only
- 3. Three letters of Recommendation IN ENGLISH (or notarized translation)
- 4. Sample Research Paper IN SPANISH
- 5. Statement of Purpose IN ENGLISH

- 6. Oral Interview could be requested, in person or by phone, if the candidate is in the short-list of applicants.

Degree Requirements

Doctor of Philosophy (Ph.D.)

The doctoral degree is a research and specialized degree and the Graduate School does not require a fixed number of credit hours. However, the Department of Spanish and Portuguese requires a total of 36 credits. Before admission to candidacy, the student must demonstrate:

1. a thorough knowledge of the literary production in the chosen area (Spanish or Spanish-American Literature);
2. an in-depth knowledge of the field of specialization;
3. proficiency in at least one field of the others Hispanic literatures;
4. a reading knowledge of a language other than Spanish and English, to be used as a research tool in the field of specialization;
5. one course in linguistics, such as "History of the Spanish Language";
6. a minimum of one course in Literary Theory and/or Criticism;
7. acquaintance with a third literature (e.g. Luso-Brazilian, French, or English); and
8. a background in supporting fields to be used as research tools (e.g. history, philosophy, political science, sociology, or art). Students must pass a comprehensive examination, a translation exam (in a language other than English and Spanish), have their dissertation proposal approved for admission to candidacy, and defend a dissertation.

Master of Arts (M.A.)

The Department offers three areas of specialization within the 30-credit MA: Spanish literature, Latin American literature, and Hispanic applied linguistics. All areas offer a non-thesis option and a thesis option, and all include a comprehensive examination. A one-credit course in methodology is required of all teaching assistants.

Literature tracks: The non-thesis option includes three credits in linguistics; three credits in literary theory and/or criticism; fifteen credits in either Spanish or Latin American literature, one of which is to be considered the candidate's main field; and nine credits in the other or "non-major" literature. Students must also submit a written scholarly paper in the final semester of their program which will be read and evaluated by at least two appropriate faculty members. Students who choose to write a thesis must meet the same criteria stated above, except that the course requirement in the "major" literature is reduced from fifteen to nine credits with six hours of thesis research credit required.

Hispanic applied linguistics track: The non-thesis option includes twelve credits in Hispanic applied linguistics, nine credits in literature, six credits in elective courses, and three credits in a final project. Students who choose to write a thesis must meet the same criteria stated above, with six thesis credits replacing course/project credits.

See the website of the Department of Spanish and Portuguese for more details: http://sllc.umd.edu/spanish/graduate.

Facilities and Special Resources

In addition to the resources of the University libraries, students have easy access to the Library of Congress, the Smithsonian Institution and other Washington-based libraries and archives. National Archives-II, located on University grounds, is readily accessible to the Campus community. Dr. Sosnowski is the founder and editor of the literary journal Hispamerica. The

graduate students publish Ojo de buey, a cultural magazine and also they have a discussion group on Creative Writing named Humo.

In association with the Latin American Studies Center, the Department promotes original initiatives on Latin American topics. Postdoctoral Fellows and Visiting Professors are an integral part of our academic program. In recent years, our faculty has been the recipient of major grants and fellowships from The Rockefeller Foundation, the National Endowment for the Humanities and the John Simon Guggenheim Foundation.

Financial Assistance

Financial assistance in the form of fellowships and assistantships is available for qualified applicants.

Contact Information

For additional information regarding the PhD or MA in literature please contact:

Dr. Ryan Long, Associate Professor & Graduate Director
Department of Spanish and Portuguese
School of Languages, Literatures, and Cultures
3215 Jimenez Hall
University of Maryland
College Park, MD 20742
Telephone: 301-405-2298
rlong12@umd.edu
http://sllc.umd.edu/spanish

For information regarding the MA track in Hispanic Applied Linguistics please contact:

Dr. Manel Lacorte, Associate Professor
Department of Spanish and Portuguese
School of Languages, Literatures, and Cultures
2202 Jimenez Hall
University of Maryland
College Park, MD 20742
Telephone: 301-405-8233
mlacorte@umd.edu

For general inquiries please contact:

Josiland Chambers
Graduate Coordinator
School of Languages, Literatures, and Cultures
1104 Jimenez Hall
University of Maryland
College Park, MD 20742
Telephone: 301-405-6021
jchamb@umd.edu

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Courses: SPAN

Related Programs and Campus Units

Education: Curriculum and Instruction
American Studies
Center for Teaching Excellence
History
Consortium on Race, Gender, and Ethnicity
English Language and Literature
Latin American Studies Center

Speech-Language Pathology (SPLA)

Faculty:

University Affiliate
Department of Hearing and Speech Sciences

Abstract

The Department of Hearing and Speech Sciences provides the opportunity for advanced graduate study in the communication sciences and disorders. At the M.A. level, a clinical degree with a concentration in Speech-Language Pathology is offered (program code SPLA). The department also offers two additional degree programs. A clinical doctorate in Audiology is offered, leading to an Au.D (program code CAUD). Second, at the doctoral level, the Ph.D. in Hearing and Speech Sciences is offered, with concentrations in Hearing, Speech or Language (program code HESP). Students applying to the Ph.D. program can opt to receive an MA in Speech-Language Pathology en route to the final degree. Applicants interested in the combined MA-Ph.D. course of study should see HESP and use the HESP code when applying for admission to study either for the Ph.D. program alone or for the combined M.A. and Ph.D. Students who wish to pursue the MA degree and Ph.D. successively should still apply to the MA program via the degree code SPLA. Admission to the M.A. program is on a very competitive basis. Each year, the Department receives approximately 250-300 applications for 25 anticipated spaces in the M.A. program in Speech-Language Pathology. Successful M.A. applicants have completed undergraduate pre-requisite coursework, typically have earned at least a 3.5 undergraduate GPA (with 3.7-3.8 being the average), and have strong GRE scores and letters of recommendation. In addition to the Graduate School requirements, the Department requires applicants to furnish scores on the Graduate Record Examination. Admission to the M.A. and CAUD programs is solely confined to fall matriculation. All students must finish their prerequisite classes before matriculating in the fall. Prospective applicants should note that decisions on admissions are made in early March. Early application is encouraged. The program typically takes 2 years of study (5 semesters, including the intervening summer). Only full-time students are admitted.

Admissions Information

Application Deadlines

Application Requirements

1. GRE General
2. 3 Letters of Recommendation
3. Unofficial Transcript - (scan/upload) copies of transcripts (official transcript is required after acceptance into the program)
4. Statement of purpose
5. Resume

Degree Requirements

Master of Arts (M.A.)

The Department of Hearing and Speech Sciences offers the Master of Arts degree with major emphasis in Speech-Language Pathology with either the thesis or the non-thesis option. The Master's degree is required by national credentialing standards for individuals intending to practice as speech pathologists in schools, hospitals, rehabilitation facilities, hearing and speech centers or in other clinical settings. Academic course work, which includes a minimum of 36 credits, is supplemented by additional credit registrations in

supervised clinical practica in the University Speech and Hearing Clinic and in selected outside clinical facilities so that the graduate will meet the academic and practicum requirements for the Certificate of Clinical Competence (C.C.C.) issued by the American Speech-Language-Hearing Association, and be eligible for licensure in the State of Maryland and other jurisdictions. The Master's degree program is accredited by the Council on Academic Accreditation, the national accrediting agency which oversees graduate programs in Speech-Language Pathology and Audiology. A full description of the Master's degree program is available at our web site, listed below.

Facilities and Special Resources

The Department's facilities include (1) the Hearing and Speech Clinic at UMCP: this clinic serves as the initial practicum site for all students pursuing clinical training. Ten speech and language diagnostic and therapy rooms are integrated with observation areas. The Clinic also includes multiple audiological test suites equipped for diagnostic testing, a complete hearing aid dispensary, a group rehabilitation room, and state-of-the-art equipment for behavioral and electrophysiological diagnostic testing, as well as hearing aid selection and fitting; students in the SPLA program will receive experience in the audiology clinic as well as the speech clinic. (2) an on-site language pre-school (LEAP, the Language-Learning Early Advantage Program), also equipped for observation. Most students will receive clinical experience through the preschool in addition to that through the HESP clinic. (3) numerous modern research laboratories equipped to support research in the areas of: psychoacoustics, infant and adult speech perception, neuropsychology, language and language development/disorders, voice, fluency., cochlear implants and electrophysiology. All of the clinical and research facilities are potentially available for the conduct of student-directed research projects, or for student participation in faculty-initiated research projects. Additional research and clinical facilities are available in the Washington and Baltimore metropolitan areas. The Library of Congress, the National Library of Medicine and the libraries of various medical schools in the Washington-Baltimore area supplement the University's extensive libraries at College Park. The Department of Hearing and Speech Sciences participates in the Neuroscience and Cognitive Sciences graduate program (see NACS), the Comparative and Evolutionary Biology of Hearing (CEBH) Training Grant, and the Maryland Language Science Center, and has ties to the Center for Advanced Study of Language (CASL); these connections afford students the opportunity to work with faculty in other departments at the University of Maryland, College Park, or at UMB.

Financial Assistance

A limited number of graduate assistantships and fellowships are available through the Department. Assistantships that carry teaching, research or clinical responsibilities are awarded on a competitive basis. The Department also recommends outstanding students for Graduate School Fellowships; many of these fellowships have early deadlines for recommendations, so students are encouraged to submit their applications to the department early to ensure full consideration for funding. Students may also seek assistantships elsewhere on campus (such as through the Dean's office or through other departments) or fellowships sponsored by private foundations (e.g., American Speech-Language-Hearing Foundation).

Contact Information

Additional information about the M.A. and Ph.D. programs may be obtained by contacting Dr. Sandra Gordon-Salant, Ph.D., Director of Graduate Studies, or by e-mailing the program at hespadmissions@umd.edu; extensive information about the Department's programs, its faculty, research and facilities may be found at our web site: http://www.hesp.umd.edu.

Director of Graduate Studies: Sandra Gordon-Salant, PhD Department of Hearing and Speech Sciences
0100 LeFrak Hall
College Park

MD 20740
Telephone: 301-405-4214
Fax: 301-314-2023
sgsalant@umd.edu; hespadmissions@umd.edu

http://hesp.umd.edu/content/program-highlights-master-arts-program-speech-language-pathology-maslp

Courses: HESP

Related Programs and Campus Units

Clinical Audiology
Second Language Acquisition-MA & Certificate
Second Language Acquisition-Ph.D.
Education: Special Education
Hearing and Speech Sciences

Survey Methodology (SURV)

Abstract

The Survey Methodology Program blends together faculty with diverse disciplinary backgrounds, all devoted to teaching state-of-the-art practices in the statistical and methodological aspects of surveys. The program's faculty come primarily from the University of Maryland, University of Michigan, and Westat, supplemented by instructors from a number of federal statistical agencies.

SURV offers a Master of Science in Survey Methodology and a Ph. D. in Survey Methodology. Both degree programs have two areas of concentration: Statistical Science and Social Science. The statistical science concentration is designed for students who wish to specialize in areas such as sample design, estimation in complex samples, variance estimation, statistical measurement error models, and statistical adjustments for missing data. The social science concentration is designed for students who wish to specialize in areas such as questionnaire design, design of interviewing systems, computer assisted data collection, modes of data collection, cognitive psychological applications to survey measurement, and nonsampling error reduction. SURV also offers two certificate programs.

Admissions Information

Applicants to the M.S. program are expected to hold a baccalaureate degree from a regionally accredited institution with a minimum of a "B" average. Post-baccalaureate coursework and relevant work experience will also be used in the application evaluation. The GRE examination is required. Entry to the statistical science concentration requires three undergraduate courses in calculus, one in linear algebra, and one in statistics. Entry to the social science concentration requires two undergraduate quantitative courses, at least one of which is in statistics, and at least two undergraduate courses in the social sciences.

Applicants to the Ph.D. program are expected to have a graduate degree in some field (such as statistics or psychology) that is related to survey methodology. Applicants must also demonstrate an appropriate quantitative background. The GRE examination is required.

Application Deadlines

Fall:
Applications must be received by January 15 .

Faculty:

Director
Conrad, Frederick G.

Assistant Director
Presser, Stanley
Valliant, Richard L.

Professor
Lahiri, Partha
Raghunathan, Trivellore E.

Associate Professor
Croninger, Robert
Kreuter, Frauke
Li, Yan
Smith, Paul

Senior Research Scientist
Tourangeau, Roger E.
Valliant, Richard L.

Associate Research Professor
Elliott, Michael

Research Associate Professor
Cantor, David

Research Professor
Brick, Michael
Conrad, Frederick G.
Couper, Mick P.
Fay, Robert E.
Lepkowski, James M.
Rust, Keith

Research Scientist
Heeringa, Steven G.

Research Assistant Professor
Montaquila, Jill

Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. GRE General required for all applicants
2. Offical transcript for all undergraduate courses
3. 3 Letters of Recommendation
4. Essay

Adjunct Professor
Schenker, Nathaniel

Adjunct Associate Professor
Willis, Gordon

University Affiliate
Biemer, Paul
Fay, Robert E.

Degree Requirements

Master of Science (M.S.)
SURV offers a non-thesis program, however students in both the statistical science and social science concentrations must fulfill a research experience requirement, yielding a scholarly paper. This paper must be the result of either original research conducted by the student, critical analysis, or evaluation of existing surveys.

Doctor of Philosophy (Ph.D.)
There are five major requirements for the Ph.D. Students must pass a qualifying examination (normally at the end of their first year) and a comprehensive examination (normally at the end of their second year). They must participate in the Ph.D. seminar for four semesters. They must meet a residency requirement which consists of spending at least two days per week at JPSM for a period of three semesters. Finally, they must complete a dissertation.

Facilities and Special Resources

SURV has the goal of offering training to all qualified students, regardless of the employment sector of interest to them. Several features of the program are designed with the working student in mind. Many class times are tailored to be compatible with the work day; a 12-month curriculum offers core courses throughout the year; and research experience requirements are integrated with work activities.

Courses have been offered at a Federal agency facility located in Washington, D.C. and interactive 2-way audio/video transmission equipment is used to transmit some courses between the College Park campus and the Ann Arbor campus of the University of Michigan,also - between College Park and the Census headquarters in Suitland, MD.

Financial Assistance

Financial assistance is available in the form of competitive fellowships and graduate assistantships for teaching or research.

Contact Information

For more information, contact: Rupa Jethwa Eapen (RJEapen@Umd.Edu).

Rupa Jethwa Eapen, Director, Administrative Services
1218 LeFrak Hall
MD 20742
Telephone: (301)314-7911
Fax: (301)314-7912
survgrad@deans.umd.edu

http://www.jpsm.umd.edu/

Courses: SURV SURV

Sustainable Development and Conservation Biology (CONS)

Faculty:

Director
Lips, Karen

Affiliate Professor
Dietz, James M.
Inouye, David W.

Lecturer
Villamagna, Amy

Abstract

The principal objective of the CONS Program is to provide graduate training in Sustainable Development and Conservation Biology. CONS is an interdisciplinary and experiential approach to the problems of biological conservation in relation to economic development necessary to meet human needs.

The primary goals of the CONS program are: 1)to provide students with the knowledge and problem-solving skills necessary to research and communicate solutions to global environmental issues; 2) to expand the reach of biodiversity conservation and increasing sustainability; 3)to produce leaders and decision-makers in conservation science that are employed by academia, in government, or non-governmental agencies (NGOs); and 4) to provide a service role to the state of Maryland, the nation, local communities, and national and international NGOs and government agencies.

Specifically the program's objectives are to: provide broad, multidisciplinary training in the core areas of biological conservation, resource economics, and policy analysis; and explicitly link the conflicting topics of sound conservation of natural resources with sustainable development to meet human needs.

CONS graduates are well-prepared to address conservation issues for employers in the private sector and in local, state and national government posts; and to enter Ph.D. programs for further, specialized training.

CONS offers a dual-degree program (PPCN) with the School of Public Policy, wherein students receive both Master of Science and Master of Public Policy degrees. For more information on our degree programs and acaeic requirements, please see our website at http://cons.umd.edu/cons

Admissions Information

Admission to the CONS Program is competitive, and applicants tend to be a self-selecting group of high achievers. Applicants must have an undergraduate degree and comply with all Graduate School guidelines to be considered for admission, with the most competitive applicants demonstrating preparedness for graduate coursework in ecology, resource economics, and public policy.

CONS has no formal course prerequisites for admission, but admission is highly competitive. CONS students have an established record of excellence in their academic (e.g., high GRE and GPA scores, prestigious honors and awards) and professional careers (e.g., relevant, real-world employment experience at NGOs, government agencies, research labs, Peace Corps, internships). CONS students have leadership abilities, and evidence of research experience (e.g., publications, presentations, internships), and are good communicators. Successful applicants typically have a strong background in biology, and are expected to have sufficient academic preparation to enroll in the required graduate level courses in Ecology, Natural Resource Economics, and Environmental Policy. It is encouraged that incoming students have taken one or more courses in statistics, other quantitative skills, mathematics, GIS analysis, economics, and/or have foreign language skills. Many prospective applicants take one or more post-baccalaureate courses in preparation.

Application Deadlines

Fall:
Applications must be received by January 15 (**January 1 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

- UM Graduate School Online Application Form
- A brief (1,000-2,000 words) statement addressing two major themes:
  1. The applicant's reasons and motivation for pursuing a graduate degree in CONS (e.g., future academic or career goals)
  2. Experiences that have helped prepare the applicant for graduate work in CONS (e.g., coursework, research, employment, internships; academic, professional, leadership, communication skills, knowledge, &/or preparedness)
- Three (3) Letters of Recommendation
- Transcripts: undergraduate, post-graduate programs
- GRE General Test scores sent from ETS (institution code: 5814)
- Curriculum Vitae
- International academic credentials (for international applicants): evidence of English proficiency, financial certification, visa documentation (see the University's International Education Services website for further details)

Degree Requirements

Master of Science (M.S.)

This Master of Science Program was initiated in 1991 to provide new training and educational emphasis in the areas of sustainable development and conservation biology. The program applies an interdisciplinary and experiential approach to the challenges of biological conservation in relation to the economic development necessary to meet human needs. It includes four components: (1) core courses in the areas of ecology and conservation biology, resource economics, public policy, and multi-disciplinary problem solving; (2) elective courses from a wide array of disciplines; (3) an internship experience relevant to the student's career interests; (4) a Scholarly Paper - a rigorous, quantitative analysis of an Environmental Problem that synthesizes the student's coursework, internship experience, and career interests. Course requirements for the program total 39 credits. This is intended to be a two-year program.

Dual Degree CONS and Public Policy Program (M.S./M.P.P)
In cooperation with the Maryland School of Public Policy, CONS offers the option of a 60-credit, dual-degree program. Upon completion, graduates receive both a Master of Public Policy (with a specialization in Environmental Policy) and a Master of Science in Sustainable Development and Conservation Biology. As environmental problems become more scientifically and politically complex, employers and researchers in the environmental analysis and policy fields are increasingly looking to hire graduates who are well-grounded in the natural and life sciences, the workings of the public, private and non-government sectors, and the key policy analysis tools and concepts. In recognition of this demand, we have established this dual degree program.This program benefits from the unique strengths of faculty in CONS by bringing together expertise in policy and the life sciences, ecological economics, international development, and conservation biology. The program will increase the number of top-notch students in classes offered within existing master's programs, help promote interdisciplinary education by providing advanced knowledge of life sciences to policy students and advanced knowledge of public policy to students in the life sciences, and expand opportunity for recruitment into Ph.D. programs in Public Affairs and Biology, and re-affirm the university's leadership position in environmental education and research. For example, CONS graduates have gone on to Ph.D. programs at UM in PUAF, AREC, MEES, and GEOG, as well as BIOL, and to a similar array of programs at other universities. Course requirements for the program total 60 credits. This is intended to be a three-year program.

Facilities and Special Resources

The program is housed within the Department of Biology but is campus-wide in scope. We have strong connections with the School of Public Policy because ~30% of CONS students are enrolled in the dual degree PPCN program. We have strong connections with AREC because CONS students take a required course in natural resource economics. All CONS students complete an internship - either in a research lab, with an NGO, or with an agency - either in the DC area or further abroad. All CONS students select a faculty advisor relevant to the topic of their scholarly paper, which results in many interactions with environmental faculty in Anthropology, Entomology, Environmental Science & Technology, Latin American Studies, MEES, Public Policy, Plant Sciences and Landscape Architecture, and other departments.

Financial Assistance

Students applying to the Program may be nominated for graduate fellowships or may be supported by teaching or graduate assistantships. Fellowship and assistantship offers are made on the basis of past academic performance, financial need, and potential to contribute to the program.

Contact Information

If you would like additional information on this program, please contact:

Dr. Karen Lips, Director
1201 Biology-Psychology Bldg. Department of Biology University of Maryland College Park
MD 20742-4415
Telephone: (301) 405-7409
Fax: (301) 314-9358
consoffice@umd.edu

http://cons.umd.edu/cons

Courses: CONS BIOL ENTM PUAF AREC PBIO GEOG ANTH

Related Programs and Campus Units

Entomology
Marine-Estuarine-Environmental Sciences
Biological Sciences

Technology Entrepreneurship (MPTE)

Faculty:

Abstract

The Master of Professional Studies in Technology Entrepreneurship unites academic insights with startup incubator skills and resources to empower students to launch and grow technology ventures. Developed by the A. James Clark School of Engineering's Maryland Technology Enterprise Institute (Mtech), University of Maryland, the MPS in Technology Entrepreneurship is a fully online program designed to equip students with a conceptual understanding of the principles and action steps of effective new venture creation and launch.

The MPS in Technology Entrepreneurship is committed to teaching the disciplines of entrepreneurial thinking that produce not just entrepreneurial inspirations but an entrepreneurial frame of mind. Courses are offered during 12-week terms; students complete course work in 11 weeks; week 12 is reserved for finals. The 30-credit, 10-

course graduate program may be completed in as little as 15 months by enrolling in two 3-credit courses per 12-week term." to "The 30-credit, 9-course graduate program may be completed in as little as 15 months. Offered through the convenience and flexibility of the online learning environment, students enroll in 6 credits per 12-week term.

The MPS in Technology Entrepreneurship prepares students to apply newly gained insights and acquired competencies to real-world innovation management challenges across five major stages of the innovation value chain from strategy development and idea generation to commercial concept and product development and successful market establishment, as well as sustainable growth in various contexts.

Admissions Information

For complete Admission Information, please visit: http://oes.umd.edu/professional-programs/technology-entrepreneurship/application-information

Admitted students participate 100% as online students. **Immigration documents (F1 or J1 student visas or an I-20) are NOT required or issued for this fully online program.** In addition to the above minimum qualifications, international students and applicants with foreign credentials have additional requirements per the Office of International Student & Scholar Services (ISSS). For additional requirements, please visit: http://oes.umd.edu/professional-programs/technology-entrepreneurship/application-information#international.

All application materials must be received by the deadlines below. Completed applications received by the earlier deadline will have priority for program spaces.

Application Deadlines

Application Requirements

Degree Requirements

Master of Professional Studies in Technology Entrepreneurship (MPTE)

The MPS in Technology Entrepreneurship is committed to teaching the disciplines of entrepreneurial thinking that produce not just entrepreneurial inspirations but an entrepreneurial frame of mind. Courses are offered during 12-week terms; students complete course work in 11 weeks; week 12 is reserved for finals. The 30-credit, 10-course graduate program may be completed in as little as 15 months by enrolling in two 3-credit courses per 12-week term.

Program Courses:
ENES660: Fundamentals of Technology Startup Ventures
ENES662: Innovative Ideas and Concept Development
ENES663: Strategies for Managing Innovation
ENES664: Business Modeling and Customer Validation
ENES665: Innovative Thinking
ENES666: Creative Design, Prototyping, and Testing
ENES667: Market Development and Commercialization
ENES668: Corporate Technology Entrepreneurship
ENES672: Launching Technology Startup Ventures

For course descriptions please click here.

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/technology-entrepreneurship

Courses: ENES

Theatre (THET)

Abstract

The School of Theatre, Dance, and Performance Studies offers graduate study leading to the degrees of Master of Arts in Theatre and Performance Studies (THPF), Master of Fine Arts in Design (MFAT), Master of Fine Arts in Performance (MFAP), Master of Fine Arts in Dance (DANC), and Doctor of Philosophy in Theatre and Performance Studies(THPF). For more information on the MFA in Dance, please see the listing for Dance in the Graduate Catalog or visit http://tdps.umd.edu.

The M.A. program is designed to enhance and develop students' practical, historical, and critical knowledge of theatre so that they may go on to graduate work in Ph.D. or M.F.A programs, or upgrade their skills for high-school teaching. The School's application deadline for best consideration for the MA program and the PhD program is January 15. Applications fully submitted by February 1 may also receive consideration on a space available basis.

The three-year M.F.A in Design degree offers superior students advanced training and opportunities for creative activity. The program prepares the student to enter the professional theatre or to teach in the creative areas at colleges or universities. The areas of concentration are costume design, set design, and lighting design. The School's application for this program is April 15 for domestic students and February 1 for international students.

The doctoral program in Theatre and Performance Studies is an interdisciplinary course of study that prepares students for careers as educators, professors in higher education, publishing scholars, and cultural critics. The program offers a rigorous exploration of both Theatre History and Performance Studies through the critical and theoretical analyses of historical archives, dramatic and performance texts, and cultural behavior as performance. Applicants who do not hold an undergraduate or graduate degree in theatre (or an equivalent field), may be required to take preparatory coursework prior to admission into the Ph.D. program.

Admissions Information

In addition to the Graduate School requirements, students desiring admission to the M.A. or Ph.D. program must provide acceptable Graduate Record Examination scores, three letters of recommendation, prior academic transcripts, a statement of interest, and a writing sample. Many applicants also submit a CV or resume.

M.F.A. in Design applicants must provide portfolio, academic transcripts, and a statement of interest in addition to the application for the Graduate School.

In most cases if applicants do not have the equivalent of an undergraduate major in their field of interest, they must take coursework in preparation for subsequent admission.

Faculty:

Area Chair
Hildy, Franklin J.
Kachman, Misha

Director
Smiley, Leigh

Professor
Conway, Daniel
Hebert, Mitchell P.
Hildy, Franklin J.
Huang, Helen Q.
Reese, Scot M.

Associate Professor
Carpenter, Faedra
Felbain, Leslie
Frederik Meer, Laurie
Harding, James
Kachman, Misha
Lee, Esther Kim
MacDevitt, Brian
Smiley, Leigh

Assistant Professor
Mezzocchi, Jared
Newsham, Jennifer Barclay

Visiting Assistant Professor
Rothman, Korey

Lecturer
Jackson, Paul D.
Mayes, Alvin

Professor Emeritus
Wagner, Daniel M.

Application Deadlines

Fall:
MA/PhD Applications must be received by December 15 (**December 15 preferred**) .
MFA in Design applications must be received by April 15 (**April 15 preferred**) .
MFA in Performance applications must be received by April 15 (**April 15 preferred**) .
Spring:
This program **does not** accept applications for this semester.
Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. 3 Letters of Recommendation
2. Statement of goals, research interests, and experience
3. MFA in Design: Portfolio required
4. Official Transcripts from all institutions
5. M.A. and Ph.D.: Writing Sample and GRE required

Degree Requirements

Doctor of Philosophy (Ph.D.)
Please contact the Head of History/Theory directly for more information.

Master of Arts or Master of Fine Arts (M.A. or M.F.A.)
The Master of Arts in Theatre and Performance Studies requires a minimum of 33 credit hours. The Department offers both the thesis and non- thesis options. Please contact the Head of History/Theory to get more details.

The M.F.A. in Design degree requires 60 credit hours. All students undertaking the M.F.A. degree must complete a thesis. Please contact the Head of Design to get more details.

Facilities and Special Resources

The School of Theatre, Dance, and Performance Studies is housed in the Clarice Smith Performing Arts Center at Maryland. This state-of-the-art facility includes the 650-seat Ina and Jack Kay Theatre, the 200-seat Robert and Arlene Kogod Theatre and the 100-seat Cafritz Theatre.

The campus is within a few miles of the John F. Kennedy Center for the Performing Arts, Arena Stage, the National Theatre, Ford's Theatre, The Shakespeare Theatre at the Lansburgh, and the Olney Theatre Center, which are among more than 80 professional area theatres. Two of the greatest libraries in the world, the Library of Congress and the Folger Shakespeare Library, are in close proximity to campus. Students also make regular use of the Smithsonian Institution, the Federal Theatre Project Archives, the National Archives, and more than 50 specialized libraries and institutions in the Washington metropolitan area.

Financial Assistance

The School nominates outstanding applicants for competitive University fellowships. Teaching assistantships are available to a limited number of students. The Graduate program head will discuss these with accepted students at the time of acceptance.

Contact Information

For additional information on a M.F.A. degree in Design, M.A. or Ph.D. in Theatre and Performance Studies, please contact:

Professor Franklin J. Hildy TDPS Director of Graduate Studies
School of Theatre, Dance, and Performance Studies
2810 Clarice Smith Performing Arts Center
College Park, MD 20742
Telephone: (301) 405-3157
Fax: (301) 314-9599
hildy@umd.edu

http://tdps.umd.edu

Ms. Stephanie Bergwall Coordinator of Graduate Services
School of Theatre, Dance, and Performance Studies 2809 Clarice Smith Performing Arts Center College Park,
MD 20740
Telephone: 301-405-6675
bergwall@umd.edu

http://tdps.umd.edu

Professor Misha Kachman, Head of MFA in Design
School of Theatre, Dance, and Performance Studies, 2739 Clarice Smith Performing Arts Center
College Park
MD 20742
Telephone: 301-405-6639
mkachman@umd.edu

http://tdps.umd.edu

Professor Franklin Hildy, Head of MA/PhD program
2828 Clarice Smith Performing Arts Center
College Park
MD 20742
Telephone: 301-405-3157
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http://tdps.umd.edu

Courses: TDPS THET

Related Programs and Campus Units

Dance

Toxicology (TOXI)

Faculty:

Abstract

The doctoral program in Toxicology and Environmental Health at the Maryland Institute for Applied Environmental Health is part of the University of Maryland System-Wide Graduate Program in Toxicology. Students will master an essential core of knowledge in toxicology and environmental and occupational health,epidemiology and biostatistics. Elective courses and rotations with faculty field studies and laboratories will offer students the backgroundand tools needed to specialize within the broader area of toxicology and environmental public health.

Admissions Information

To apply to the PhD program in Toxicology and Environmental Health, applicants must complete their application in SOPHAS. www.sophas.org

Application Deadlines

Application Requirements

1. Minimum 3.0 undergraduate GPA 2. Undergraduate transcripts 3. GRE scores taken within the past 5 years 4. 3 letters of recommendation that address the applicant's academic capabilities and probability of success in graduate school 5. Statement of goals and interests and their congruence with those of the program 6. Relevant academic/work experience, including previous coursework in biology, chemistry, mammalian physiology, mathematics, statistical methods, and/or statistical software packages.

Degree Requirements

Doctor of Philosphy (Ph.D)

Doctorate in Toxicology and Environmental Health (PhD) (PhD)
The PhD program consists of a minimum of 46 credit hours of graduate courses. Graduate courses include (1) Toxicology and Environmental & Occupational Health, (2) Basic Epidemiology and Biostatistics, (3) and two areas of specialized focus (Advanced Epidemiology/Biostatistics, Analytical Chemistry, Pharmacology, Pathology/Immunology/Microbiology, or Environmental Science/Ecology/Climate). Program requirements for a PhD degree in toxicology also include successful completion of a written and oral comprehensive exam in the format of an NIH research proposal, oral defense of a written dissertation research proposal, and a minimum of 12 credits of PhD dissertation research, written dissertation, and a final dissertation defense. The program can be completed on either a full- or part time basis. It is anticipated that students will complete more than the minimum number of credits.

Facilities and Special Resources

The proximity of the University of Maryland, College Park to the nation's capital offers prospective students unparalleled opportunities for internships and research experiences in public health, including placements at the National Institutes of Health, the CDC Washington Office, the U.S. Department of Health and Human Services, Children's National Medical Center, the Maryland Department of Health and Mental Hygiene, and many other national, state, and local health agencies. The diversity of cultural and socioeconomic groups, communities, industries, and health organizations provides a rich environment for learning, research, public policy analysis, and service.

Financial Assistance

Contact Information

Maryland Institute for Applied Environmental Health 2234 School of Public Health Building (#255) University of Maryland College Park
MD 20742
Telephone: Telephone: 301-405-5509
Fax: Fax: 301-314-1012
miaeh@umd.edu

http://www.sph.umd.edu/miaeh/

Courses:

Translation (MPTR)

Faculty:

Acting Director
Parry-Giles, Shawn J.

Abstract

The Master of Professional Studies in Translation (MPS in Translation) is designed to equip students with the required competencies to compete successfully for work as specialized translators, project managers, or administrators of language services.Example skills include the translation of specialized texts in health, legal and political settings, including the translation of documents and websites for major corporations, international organizations, and government ministries.

The MPS in Translation is a two-year, 41 credit program. In the first year, you begin to develop high-level skills in translation in specific domains (specialized written texts). In the program's second year, you build on these fundamental skills, specializing in written communication for governmental and international organizations.

Admissions Information

For complete Admission Information, please visit: http://oes.umd.edu/professional-programs/interpreting-translation/gsit-admission-information

Application Deadlines

Application Requirements

Degree Requirements

Master of Professional Studies in Translation (MPTR)
The MPS in Translation is a two-year, 41 credit program. In the first year, you begin to develop high-level skills in translation in specific domains (specialized written texts). In the program's second year, you build on these fundamental skills, specializing in written communication for governmental and international organizations.

Graduate Certificate of Professional Studies in Translation (Z079)
The Graduate Certificate of Professional Studies in Translation (GCPS in Translation) is designed to equip you with the knowledge and skills required for entry-level work in the translation profession. Examples include serving as translators of general texts for information purposes and specialized texts in subject areas wherein you hold advanced qualifications (e.g., Master of Arts degree, and/or significant professional expertise). You will be grounded in the tenets of the profession, including professional conduct and ethics and guided through the steps needed to advance your professional skill set.

The GCPS in Translation is a 21-credit one year program, offering instruction in the fundamental skills of translation and includes the theoretical fields of translation studies, the translation professions, intercultural communication, and background knowledge in at least one of the following communication contexts: political communication, legal communication, or health communication.

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-7762
oes@umd.edu

http://oes.umd.edu/professional-programs/interpreting-translation

Courses:

Urban Studies and Planning (CMPL)

Abstract

The Urban Studies and Planning Program offers graduate study leading to the Master of Community Planning (MCP) degree. (The School of Architecture, Planning and Preservation, in which the MCP program is located, offers a Ph.D. in Urban and Regional Planning and Design -- see URPD for details). The MCP Program is accredited by the Planning Accreditation Board of the American Institute of Certified Planners and the Association of Collegiate Schools of Planning. Dual Masters degrees in Planning and Architecture, and Planning and Historic Preservation, are offered. There is a transfer of credit agreement with the School of Law on the Baltimore campus as part of a joint JD and MCP program. There is also a cooperative program with the PhD program in Policy Sciences at the UMBC campus. Entering students have diverse academic backgrounds, such as architecture, fine arts, English, history, business, geography, sociology, economics, and political science. The Program's faculty specialize in metropolitan and regional planning, housing, transportation planning, environmental and land use planning, social policy, quantitative planning methods, urban design, and economic development planning. Employment opportunities remain strong for graduates in a highly competitive field. The Baltimore-Washington metropolitan region offers diverse employment potential in urban planning and program management in the public, private, and non-profit sectors.

Admissions Information

The application process consists of the following:

First, fill out the on-line application for the University of Maryland Graduate School. The administrative code for the Community Planning program is "CMPL."

Second, submit all transcripts, three professional letters of recommendation, statement of purpose, resume, official GRE test scores, and portfolio as part of the application.

All applicants must have a bachelor's degree from an accredited institution. There is no restriction on the applicants' previous field of study, and indeed we encourage diversity in all senses.

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. Statement of Purpose - specific to interest in dual degree
2. Graduate Record Examination (GRE), Graduate Management Admission Test (GMAT, or Law School Admissions Test (LSAT)
3. Transcript(s)
4. Letters of Recommendation (3)
5. CV/Resume
6. TOEFL/IELTS/PTE (international applicants only)

Faculty:

Director
Cohen, James R.

Professor
Howland, Marie
Knaap, Gerrit

Associate Professor
Chen, Alexander
Dawkins, Casey
Ding, Chengri

Assistant Professor
Lung-Amam, Willow
Iseki, Hiro

Research Associate
Liu, Chao

Research Professor
Avin, Uri

Assistant Research Professor
Dempwolf, Scott

Senior Lecturer
Cohen, James R.

Degree Requirements

Master of Community Planning (M.C.P.)
Graduation requires satisfactory completion of 48 credits of course work. The 12 credits in core courses introduce students to the foundations of city and regional planning, research methods, planning process, and planning history and theory. An additional nine "spread" credits give students a grounding in physical, social and economic planning. Nine additional credits are required for a specialization. Specializations include housing, economic development, social planning and management, transportation planning, urban design, historic preservation, land use/environmental planning, and international planning. A studio and internship are required. Courses are listed under URSP. The MCP program accepts up to nine credits from other graduate programs. Applicants to this program should use the CMPL program code.

Ph.D. in Urban and Regional Planning and Design (Ph.D.)
The Ph.D. program in Urban and Regional Planning and Design (URPD) is offered by the School of Architecture, Planning and Preservation. To apply to this program an applicant should have already earned a masters degree by the time of intended enrollment. Applicants interested in the Ph.D. program may obtain information in this catalog under "Urban and Regional Planning and Design (URPD)".

Juris Doctor / Master of Community Planning Joint Degree (LCPL)
The University of Maryland School of Law on the Baltimore campus (UMB) will accept up to 9 credits of MCP coursework towards the J.D. degree, and the Urban Studies and Planning Program will accept up to 9 credits of J.D. coursework towards the MCP degree. Applicants must apply to each program separately and be accepted by both programs. Credits from the MCP program can be transferred to the Law program only if they are taken while the student is enrolled in the Law program, and vice versa. Applicants interested in this joint program should use the LCPL code when applying to the Urban Studies and Planning Program.

Dual Degree in Community Planning and Historic Preservation (CPHP)
The dual degree combines course work from the Urban Studies and Planning and Historic Preservation programs to enable a student to complete both the Master of Community Planning and the Master of Historic Presevation with fewer credits than it would take to complete the two separately. Applicants for the dual degree in Community Planning and Historic Preservation should use the CPHP program code.

Dual Degree in Architecture and Community Planning (ARCP)
The joint degree combines course work from the Architecture and Urban Studies and Planning programs. Students of the joint-degree program acquire specialized knowledge tailored to understanding the urban environment from several perspectives. Students learn how social, economic,and political forces have led to the development of human habitats. The emphasis on urban design in the joint degree program yields an education that is particularly applicable for persons interested in the revitalization of metropolitan areas and their center cities. Applicants interested in this degree should already have an undergraduate degree in architecture. Applicants for this joint degree should use the ARCP program code.

Facilities and Special Resources

The University of Maryland is an excellent location for the pursuit of community planning, and graduate students are encouraged to take advantage of the opportunities. The university is eight miles from the incomparable library and research facilities of Washington, D.C. In the nations's capital, UMCP graduate students have access to, among other resources, the Library of Congress, the specialized collections of professional associations and international organizations, and agencies at all levels of government. The College Park campus is a 45-minute drive from Baltimore City, whose planning programs have gained national attention. At least two planning studio courses are offered each year, in either Baltimore, the Washington metropolitan area, or an

international setting. Baltimore city and Washington, D.C. are ideal laboratories for students interested in research on urban issues and planning.

Urban Studies and Planning is one of five graduate degree programs in the University's School of Architecture, Planning, and Preservation. The School administers the National Center for Smart Growth Research and Education, which involves faculty and graduate students from several campus units in: multi-disciplinary research on the fiscal, environmental and social impacts of alternative development patterns; evaluation of growth management strategies (with a focus on Maryland's Smart Growth programs); technical assistance to state agencies and local jurisdictions; and training programs for federal program managers and state and local officials.

Financial Assistance

Aside from student loans through the university, MCP students are eligible to apply for graduate assistantships with URSP and the National Center for Smart Growth Research and Education. MCP applicants who are also Peace Corps veterans are eligible to apply for the Shriver Peaceworker fellowship program that is administered by the University of Maryland Baltimore County. Please note that competition is high for these financial awards. The program also maintains a list of internships, and many of our students work in part- or full-time jobs while completing the program. Program classes are scheduled to begin at 4:00 p.m. and 7:00 p.m. to accommodate our working students.

Contact Information

Contact the program at the following address:

CMPL Graduate Admissions
School of Architecture, Planning, and Preservation
University of Maryland
College Park, MD 20742

Or at the School of Architecture web site: www.arch.umd.edu

James Cohen, PhD, Director, Community Planning Program
University of Maryland School of Architecture, Planning and Preservation Building 145
College Park
MD 20742
Telephone: 301-405-8000
jimcohen@umd.edu

http://arch.umd.edu/ursp/urban-studies-and-planning

Courses: ARCH URSP HISP

Related Programs and Campus Units

Architecture
Urban and Regional Planning and Design
Real Estate Development
Landscape Architecture
Architecture and Real Estate Development

Urban and Regional Planning and Design (URPD)

Faculty:

Associate Dean
Howland, Marie

Abstract

The School of Architecture, Planning and Preservation offers a Doctoral Program, the Ph.D. in Urban and Regional Planning and Design. Participating programs include Urban Studies and Planning, Architecture, Historic Preservation, Landscape Architecture, and The National Center for Smart Growth Research and Education. The program prepares students to teach at the university level in departments of Urban Planning, Architecture, Historic Preservation, Real Estate Development, or Landscape Architecture, as well as qualifies graduates to conduct research and participate in high-level decision-making in the public, private, and nonprofit sectors.

Admissions Information

Application Deadlines

Fall:
Applications must be received by December 15 .
Spring:
This program **does not** accept applications for this semester.

Application Requirements

1. Complete application form: (On-line version)
2. Academic credentials (official transcripts to Graduate School):
3. Standardized test scores: Graduate Record Examinations (GRE)
4. Letters of Recommendation: Three confidential letters submitted by professors or others.
5. Statement of Goals, Research Interests, and Experiences: 1000-2000 word statement of graduate goals, research interests, and experiences.

Degree Requirements

Urban and Regional Planning and Design (Ph. D.)
The Ph.D. in Urban and Regional Planning and Design is a 39-credit program. The program is highly selective and individualized. Approximately five students will be admitted each year. Adequately prepared students will generally need four semesters of formal course work leading to comprehensive exams and all students are required to spend a minimum of two years in residence. The program is designed as a full-time program to be completed in four years.

Students admitted to the doctoral program will be expected to have completed a master's degree in a related field including, but not exclusively, urban planning, architecture, historic preservation, real estate development, or landscape architecture. Students are expected to enter the Ph.D. program with two semesters of graduate level quantitative research methods. These courses can be taken after entrance to the program and prior to their advanced methods course.

Financial Assistance

The School of Architecture, Planning, and Preservation, and The National Center for Smart Growth Research and Education together anticipate three research assistantships available to Doctoral students. Compensation for assistantships includes tuition remission for up to 10 credit hours per semester, plus a stipend. For more information contact the Doctoral Program.

Contact Information

Marie Howland, Ph.D., Director
School of Architecture, Planning, and Preservation,
College Park
MD 20742
Telephone: (301) 405-6791
Fax: (301) 314-9583

Director
Howland, Marie

Professor
Baum, Howell S.
Hurtt, Steven W.
Knaap, Gerrit
Vann, Robert L.

Associate Professor
Bell, Matthew J.
Bovill, Carl H.
Chen, Alexander
Dawkins, Casey
Ding, Chengri
Eisenbach, Ronit
Gournay, Isabelle J.
Simon, Madlen

Assistant Professor
Hiro Iseki

Lecturer
Cohen, James R.

University Affiliate
Chanse, Victoria
Lung-Amam, Willow

mhowland@umd.edu

http://arch.umd.edu/phd/phd-home

Courses: URSP ARCH HISP RDEV

Related Programs and Campus Units

Architecture
Urban Studies and Planning
Historic Preservation
Real Estate Development
Center for Superconductivity Research

Veterinary Medical Sciences (VMSC)

Note: Some courses in this program may require the use of animals. Please see the statement on Animal Care and Use and the Policy Statement for Students in the Appendix.

Abstract

The Virginia-Maryland Regional College of Veterinary Medicine (VMRCVM) is the only truly regional veterinary college in the United States. The College was established as a joint venture between two major land grant universities, the University of Maryland and Virginia Polytechnic Institute and State University (Virginia Tech). The College has three major campuses: The Avrum Gudelsky Veterinary Center in College Park, Maryland, the Marion Scott Dupont Equine Medical Center in Leesburg, VA, and the main teaching hospital and research facility at Blacksburg, Virginia. The Maryland campus of the VMRCVM focuses on research, education and outreach, and our faculty provide a myriad of related services throughout the Mid-Atlantic region. Veterinary teaching hospitals are located in Blacksburg and Leesburg, VA. The Veterinary Medical Sciences (VMSC) Graduate Program in the Maryland campus of the VMRCVM at the University of Maryland College Park (UMCP) is a collaboration in graduate education and research between UMCP and Virginia Tech, providing benefits in education and research from both universities. The VMSC Graduate Program includes faculty with a wide range of research interests in the areas of cell biology, immunology, infectious and zoonotic diseases, and poultry health management and disease prevention. The VMSC Graduate Program offers Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees.

Admissions Information

Applicants with a veterinary degree (DVM or equivalent), a Bachelor of Science (for M.S. or PhD program applicants), or a Master of Science (for most PhD applicants) in a biological science or related field of study are eligible for admission to the VMSC Graduate Program.

A minimum Grade Point Average (GPA) of 3.0 on a 4.0 scale (B or better) and a minimum Graduate Record Examination (GRE) combined score of 1100 (verbal and quantitative) are required. The GRE score for either the verbal or quantitative section should not be less than 400. The analytical score should not be less than 4. International applicants are required to attain the minimum Test of English as a Foreign Language (TOEFL) score of 100 on the internet-based test (IBT) for unconditional admission. In addition, the following sectional scores must be met: Speaking: 22; Listening: 26; Reading: 26; and Writing: 26.

Application Deadlines

Faculty:

Chair
Samal, Siba K.

Graduate Director
Zhu, Xiaoping

Professor
Samal, Siba K.
Zhu, Xiaoping

Associate Professor
John T. Patton
Nelson, Daniel
Pal, Utpal
Tablante, Nathaniel L.
Zhang, Yanjin

Assistant Professor
Georgiy (George) Belov
Shi, Meiqing

Professor Emeritus
Mallinson, Edward

Fall:
Applications must be received by May 1 .
Spring:
Applications must be received by October 1 .
Summer:
This program **does not** accept applications for this semester.

Application Requirements

The following materials must be submitted online or by mail to:
University of Maryland College Park
Enrollment Services Operations
Application for Graduate Admission
Rm 0130 Mitchell Building
College Park, MD 20742

1. Application form and $75 non-refundable application fee
2. Official academic transcripts reflecting undergraduate and graduate work
3. TOEFL Scores (for international applicants whose native language is not English)
4. 3 Letters of recommendation
5. GRE scores (University of Maryland Institution Code is 5814)
6. Statement of career goals and research interests

In addition to the above requirements, applicants must submit to the VMSC Graduate Program, a current resume or curriculum vitae.

Degree Requirements

Master of Science (M.S.)
During the first semester the student selects an advisor, and with the help of the advisor forms an Advisory Committee with the approval by the program's Graduate Education Committee. By the end of the second semester with the advice of the Advisory Committee, the student files a proposed schedule of course work including at least one credit of seminar (VMSC 698). A minimum of 24 semester with hours of graduate courses and six hours of thesis research credit (VMSC 799) is required for the degree. No less than 12 credits should be from courses 600 level or higher; at least 12 credits must be earned in the major subject. Three credits of graduate biometrics or biochemistry and one seminar credit (VMSC 698) are required. No more than two credits of Special Problems (VMSC 699) are acceptable as part of the 24 required course credits. Students must maintain an overall GPA of 3.0 or better in courses taken for graduate credit. The committee may require remedial courses if the student enters with inadequate prerequisites or deficiencies in the undergraduate program. By the end of the second semester, a thesis research proposal must be approved and filed. The student must present the thesis in a public seminar and pass a final oral examination given by the Advisory Committee. Details on the Graduate School policy on the Master's Thesis Examination may be found in the Graduate School Catalog at http://www.gradschool.umd.edu/catalog/masters_degree_policies.htm

The thesis must be submitted to the Graduate School in electronic format after final approval of the document by the Thesis Examining Committee. See the University of

Maryland Thesis and Dissertation Style Guide (http://www.gradschool.umd.edu/etd) for the details of this process.

Students with adequate undergraduate training usually complete the master's degree within two years.

Doctor of Philosophy (Ph.D.)
Applicants with a D.V.M., M.D., or equivalent or related degree in biological sciences plus a M.S. degree may be admitted to the Ph.D. program. In exceptional cases, admission to the Ph.D. program without a M.S. degree may be considered but these candidates must complete a minimum of 24 hours of course work. Ph.D. candidates who have previously completed the D.V.M. and/or M.S. degree must meet the minimum course requirements of 12 credits, and a minimum of twelve dissertation research credits (VMSC 899). No more than two credits of Special Problems (VMSC 699) are acceptable as part of the 12 required course credits. Two additional seminar credits (VMSC 698) are required.

Students are required to register for one seminar credit (VMSC 698) each academic year. Two seminar credits will be counted toward degree requirements. All students are expected to attend seminars regularly.

Students are required to take a written and oral comprehensive examination and submit and defend their Ph.D. dissertation in partial fulfillment of the doctoral degree (see below).

During the first semester, the student selects an advisor and with the help of the advisor forms an Advisory Committee. The Advisory Committee and the student must meet by the end of the second semester to approve the student's plan of study. By the end of the second semester the student will submit to the Advisory Committee a dissertation research proposal. An oral and written comprehensive examination is required for advancement to candidacy. Prior to the final dissertation, an oral examination is required for advancement to candidacy. A student must be admitted to candidacy for the doctorate within five years after admission to the doctoral program and at least six months before the date on which the degree will be conferred. It is the responsibility of the student to submit an application for admission to candidacy when all the requirements for candidacy have been fulfilled. Applications for admission to candidacy are made in duplicate by the student and submitted to the graduate program for further action and transmission to the Graduate School . Application forms may be obtained at the Graduate School, Room 2123, Lee Building, or on the web. Paperwork must be received by the Graduate School prior to the 25th of the month in order for the advancement to become effective the first day of the following month. Doctoral candidates are automatically registered for six (6) credits of Doctoral Dissertation Research (899), for which they pay the flat candidacy tuition.

Prior to the final dissertation oral examination, the candidate must present a public seminar. Details on the Graduate School policy on the Doctoral Dissertation and Examination may be found in the Graduate School Catalog at: http://www.gradschool.umd.edu/catalog/doctoral_degree_policies.htm

Dissertations are to be submitted to the Graduate School in electronic format after final approval of the dissertation by the Dissertation Examining Committee. See the University of Maryland Electronic Thesis and Dissertation (ETD) website at http://dissertations.umi.com/umd or the University of Maryland Thesis and Dissertation Style Guide (http://www.gradschool.umd.edu/styleguide) for the details of this process.

Facilities and Special Resources

The Avrum Gudelsky Veterinary Center, the University of Maryland home of the VMRCVM, lies in the heart of Maryland's thriving biotechnology community, and is near Maryland's major university research campuses and government laboratories, including the USDA Beltsville Agriculture Research Center, the National Institutes of Health, and Walter Reed Armed Forces Institute of Pathology. The Center contains 32,000 square

feet of research and support laboratories, including animal care facilities. The 10,000 square-foot research laboratories are fully equipped with state-of-the-art facilities for molecular biology research, cell culture facilities, a confocal microscope, a fluorescence activated cell sorter, and a sophisticated electron microscope suite. Approximately 18,000 square feet of space comprise Biological Safety Levels 2 and 3 facilities and facilities for laboratory animals and poultry. The poultry unit has 15 rooms for housing poultry, each equipped with 20 poultry isolators to contain any infectious pathogens and maintain a disease-free environment. The animal facility has a fully equipped necropsy room designed for postmortem analysis.

The Avrum Gudelsky Veterinary Center also houses the drug-testing laboratory of the Maryland Horse Racing Commission, and the Poultry Research and Development Unit of Synbiotics Corporation. This co-location facilitates active collaboration in both applied and basic research on diseases of animals.

The Laboratory for Biological Ultrastructure in the Department of Biology is equipped with a transmission and scanning electron microscope, a confocal light microscope, ultramicrotomes, and equipment for freeze-fracture studies. The Department of Cell Biology and Molecular Genetics has a Fluorescence-Activated Cell Sorter for supporting cell biology research.

The campus has Central Animal Resource Facilities (CARF) for maintaining laboratory animals to facilitate animal research.

Extensive library facilities are available on campus. In addition, the College Park campus is close to the National Agricultural Library (NAL) and the National Library of Medicine (NLM). The Library of Congress and the National Archives, along with several other libraries of biomedical research and academic institutes, are located within a short driving distance.

Computer facilities at the University of Maryland are outstanding. Veterinary Medicine provides computer access to all faculty and graduate students. Students are provided with e-mail accounts and free Internet access. The campus maintains both Unix and mainframe systems, and access to supercomputers for specific research projects. Software for graphics, modeling, statistics, and the analysis of molecular data is readily available.

The College Park campus is also ideally situated near a number of federal agencies involved in veterinary medical sciences. Collaborative initiatives are underway with the U.S. Food and Drug Administration's Centers for Veterinary Medicine (CVM) and Food Safety and Applied Nutrition (CFSAN); U.S. Department of Agriculture's Animal and Plant Health Inspection Services (APHIS), Food Safety and Inspection Service (FSIS), Agricultural Research Service (ARS), and Beltsville Agriculture Research Service (BARC); National Institutes of Health (NIH); Walter Reed Armed Forces Institute of Pathology (AFIP); World Bank; and Pan American Health Organization (PAHO). Scientists from some of these agencies have adjunct appointments with the College of Veterinary Medicine and participate on students' graduate committees.

Financial Assistance

A number of graduate assistantships are available and awarded to candidates with strong academic records.

Teaching Assistantships, Research Assistantships, Scholarships, and Fellowships are available on a competitive basis. Research Assistantships (RAs) are 12-month appointments and Teaching Assistantships (TAs) are 10-month appointments. Benefits for each assistantship include stipends, ten credits of tuition remission per semester, and health benefits. Generally, student assistantships are offered for two years for an M.S. degree and four years for a Ph.D. degree.

Sources of funding include the VMRCVM; Maryland Agricultural Experiment Station; Maryland Cooperative Extension; College of Agriculture and Natural Resources; Graduate School open-nomination and block grant fellowships (for recruitment of new students only); University diversity fellowships; endowed fellowships; and funds from faculty research contracts and grants. Inquiry about the stipends can be made to the VMSC Graduate Program.

Contact Information

Contact the members of the Graduate studies committee and the VMSC graduate program Website http://www.gradschool.umd.edu/catalog/programs/VMSC.html

Dr. Xiaoping Zhu,
Professor and Director, VMSC Graduate Program
Avrum Gudelsky Veterinary Center,
8075 Greenmead Drive,
College Park
MD 20742
Telephone: (301) 314-6814
Fax: (301) 314-6855
xzhu1@umd.edu

Courses: VMSC BIOM BCHM ANSC MICB MOCB

Related Programs and Campus Units

Animal Sciences
Biological Sciences

Women's Studies (WMST)

Abstract

Women's Studies offers an interdisciplinary and integrative program of study leading to the Master of Arts and Doctor of Philosophy degrees. Students will be expected to develop a thorough grounding in the new scholarship on women; acquire an understanding of gender as a category of analysis; analyze and assess theories about the role of gender in systems of hierarchy and its intersection with other categories of difference, such as race, ethnicity, religion, class, sexuality, disability, and age; develop competence in women's studies theories, research methods, and pedagogy, including issues related to women's diversity nationally and globally; and achieve competence in a selected area of specialization.

Admissions Information

Application requirements include a Graduate School application, application fee, official transcripts, GRE scores, (3) letters of recommendation with rating sheets, scholarly writing sample with footnotes approximately 10 pages in length, personal statement of purpose, including research interests, and a CV or resume. Also, please do not submit supporting documents until you have completed and submitted your application. Additional requirements for International students can be found at the following website: www.gradschool.umd.edu/prospective_students/international_admissions.html

Application Deadlines

Fall:
Applications must be received by December 1 .
Spring:
This program **does not** accept applications for this semester.

Faculty:

Professor
Dill, Bonnie T.
Kim, Seung-Kyung
King, Katherine R.
Zambrana, Ruth Enid

Associate Professor
Barkley Brown, Elsa
Horton-Stallings, LaMonda
Rowley, Michelle V.
Schuler, Catherine A.
Tambe, Ashwini

Assistant Professor
Benedicto, Roberto
Lothian, Alexis

Affiliate Professor
Chernela, Janet
Coletti, Theresa M.
Collins, Merle
Collins, Patricia Hill
Desai, Sonalde B.
Doherty, Lillian E.
Donawerth, Jane L.
Frederiksen, Elke P.
Freidenberg, Judith N.
Hallett, Judith P.
Kauffman, Linda
Klees, Steven J.
Lin, Jing
Logan, Shirley W.
Michel, Sonya A.

Summer:
This program **does not** accept applications for this semester.

Application Requirements

1. Graduate School application and fee
2. Official transcripts from all institutions attended, including all undergraduate and graduate work
3. GRE Scores
4. TOEFL Scores are required for international applicants, from countries where English is not the primary language
5. 3 Letters of Recommendation with ranking sheets
6. 10 page (maximum) Writing Sample (please use a scholarly format with footnotes)
7. Personal statement of purpose and experience, including research interests
8. C.V. or resume

Degree Requirements

Master of Arts (M.A.)

Women's Studies does not have a stand-alone M.A. program. However, on the way to a Ph.D., students who have completed the appropriate coursework may request conferral of a master's degree. Students will begin the graduate program with a sequence of courses that include the required core interdisciplinary courses for a total of 31 credits and finish with either the completion of a thesis or the 'general' examination. This portion of the program stresses interdisciplinary Master's courses offered in the Department of Women's Studies.

Doctor of Philosophy (Ph.D.)

Students' continued participation in the doctoral program is dependent upon the quality of their coursework, research and writing, the completion of an interdisciplinary paper and successfully passing exams. After successfully completing the M.A. portion of the program, students will meet with a committee of advisors to determine the balance of their program of coursework. A full complement of courses is oriented toward two enterprises: 1) developing a major field and passing a major field exam, i.e. an interdisciplinary topical inquiry, that will support the dissertation; and 2) developing the research skills of two methodologies. In addition, students must and demonstrate reading competency in a language other than English, relevant to their course of study. Students entering with a bachelor's degree are required to complete a minimum of 54 credits, including 12 dissertation research credits. Students entering with a graduate certificate in Women's Studies or a master's degree are required to take a minimum of 34 credits, including 12 dissertation research credits.

Facilities and Special Resources

Resources for research in the College Park and Washington D.C. are unsurpassed. The University's libraries hold around 2,500,000 volumes. In addition to the outstanding holdings of the Library of Congress, the area also offers the specialized resources of the National Archives and Archives II (located on the grounds of the University of Maryland); the Smithsonian Institution; the National Museum of Women in the Arts; and a broad array of public policy organizations and "think-tanks," such as the Institute for Women's Policy Research, Women's Legal Defense Fund, National Organization for Women, American Association of University Women, Women's Research and Education Institute, National Women's Law Center, American Council on Education's Office of Women in Higher Education, Business and Professional Women's Foundation, Center for Policy Alternative's Women's Policy and Programs, Center for Women's Policy Studies, Feminist Majority, General Federation of Women's Clubs International's Women's History and Resources Center, International Center for Research on Women, National Association for Women in Education, Program on the Studies and Education on Women of the Association of American Colleges and Universities, and the Union Institute Center for Women, plus the many research and policy institutes with include gender issues as part of their agenda.

Mossman, Carol A.
Muncy, Robyn L.
O'Brien, Karen Mary
Orlando, Valerie
Oster, Rose-Marie G.
Paoletti, Jo B.
Paolisso, Michael J.
Parry-Giles, Shawn J.
Ray, Sangeeta
Rosenthal, Laura
Scholnick, Ellin K.
Smith, Martha Nell
Steiner, Linda
Stromquist, Nelly
Struna, Nancy L.
Toth, Elizabeth L.
Washington, Mary Helen
Wong, Janelle
Zilfi, Madeline C.

Affiliate Associate Professor
Aldoory, Linda
Baer, Hester
Bianchini, Janna
Carpenter, Faedra
Chico, Tita
Coles, Kimberly
Dwyer, Susan
Eades, Caroline M.
Enoch, Jessica
Farman, Jason
Felbain, Leslie
Frederik Meer, Laurie
Geores, Martha E.
Grossman, Maxine
Hanhardt, Christina Benes
Harley, Sharon
Jelen, Sheila
Khamis, Sahar Mohamed
Leslie, Leigh A.
Lindemann, Marilee
Lyons, Clare A.
Madhavan, Sangeetha
Marsh, Kris
Mason, Michele M.
Nunes, Zita
O'Meara, Kerry Ann
Ontiveros, Randy
Parks, Sheri L.
Penrose, Mehl
Rodriguez, Ana Patricia
Rosemblatt, Karin A.
Rosemblatt, Karin A.
Sies, Mary C.
Williams-Forson, Psyche

Affiliate Assistant Professor
Baillargeon, Mercedes
Bruce, La Marr Jurelle
Kleykamp, Meredith
Koser, Julie
Park, Julie
Ray, Rashawn
Sangaramoorthy, Thurka

University Affiliate
Carluccio, Danielle
Jensen, Luke
Keshavarz, Fahtemeh
Mahmoudi, Hoda
Moghadam, Linda L.

Professor Emerita
Beck, Evelyn T.
Bolles, A. Lynn
Moses, Claire G.

The National Women's Studies Association, the professional association of the discipline is located in Baltimore, and one of the leading scholarly journals in our field, Feminist Studies, is located on our campus. Some graduate students may be able to broaden their experience and enhance the applicability and marketability of their coursework by undertaking internships in these two organizations.

The University of Maryland Consortium on Race, Gender and Ethnicity offers grant-getting potential and otherwise support the research endeavors of faculty in these fields. Grants funded through the Consortium will provide additional funding for Women's Studies graduate students and invaluable research experience. High enrollment demand in Women's Studies introductory CORE courses provide yet another opportunity for funding graduate student's programs of study with teaching assistantships.

Rosenfelt, Deborah S.
Strauch, Gabriele L.
Vaughan, Mary Kay

Financial Assistance

The Women's Studies Department awards a small number of recruitment fellowships to selected candidates. Women's Studies also awards teaching assistantships, research assistantships, and administrative assistantships, are the primary forms of financial aid. These assistantships carry a stipend, insurance benefits, and remission of tuition up to ten credit hours each semester.

Contact Information

Additional information on admission, degree requirements, and financial aid can be obtained from:

Cliffornia R. Pryor/Program Administrative Specialist
2101 Woods Hall
MD 20742
Telephone: (301) 405-6877
Fax: (301) 314-9190
womensstudies@umd.edu

http://www.wmst.umd.edu

Courses: WMST

Related Programs and Campus Units

Anthropology

Working with Survivors of Violence, Torture, and Trauma: Theoretical Foundations and Mental Health Interventions (Z075)

Faculty:

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Abstract

The Graduate Certificate of Professional Studies in Working with Survivors of Violence, Torture, and Trauma (VTT): Theoretical Foundations and Mental Health Interventions offers professionals who work with survivors of psychological trauma the opportunity to acquire additional knowledge and to enhance their training in working with survivors of trauma and violence. VTT is a fully online program offered through the distinguished Counseling Psychology program in the Department of Psychology at the University of Maryland.

VTT focuses on topics such as the psychological, emotional, neurobiological, social, and clinical implications of complex and simple trauma, vicarious traumatization, and unique concerns in the professional relationship. Students learn about how to work effectively with torture survivors as well as the psychological, social/familial, spiritual, physical, community, and political impact of trauma. test

Admissions Information

For complete Admission Information, visit: http://oes.umd.edu/professional-programs/vtt/vtt-admission-information

UMD cannot issue the immigration documents necessary for international students to study (F1 or J1 student visas) in this program. International students who currently reside in the U.S. on existing visas may apply. Eligible international students have additional requirements per the Office of International Student & Scholar Services (ISSS). For additional requirements, please see: http://oes.umd.edu/professional-programs/vtt/vtt-admission-information#international

All application materials must be received by the deadlines below.

Domestic students:
Term I (Fall): by June 1
Term III (Spring): by December 1

International students:
Term I (Fall): by February 1
Term III (Spring): by October 1

Application Deadlines

Application Requirements

Degree Requirements

Working with Survivors of Violence, Torture, and Trauma (GCPS)

Financial Assistance

Contact Information

Office of Extended Studies
0132 Main Administration Building
MD 20742
Telephone: 301-405-9708
oes@umd.edu

http://oes.umd.edu/professional-programs/vtt

Chapter 5: Graduate Courses

Afro-American Studies (AASP)

AASP 400 Directed Readings in African American Studies (3 credits)

Prerequisite: AASP202 or AASP100.
The readings will be directed by the faculty of African American Studies. Topics to be covered will be chosen to meet the needs and interests of individual students.

AASP 402 Classic Readings in African American Studies (3 credits)

Prerequisite: AASP202 or AASP100.
Classic readings of the social, economic and political status of blacks and other minorities in the United States and the Americas.

AASP 411 Black Resistance Movements (3 credits)

Prerequisite: AASP100.
A comparative study of the black resistance movements in Africa and America; analysis of their interrelationships as well as their impact on contemporary pan-Africanism.

AASP 441 Science, Technology, and the Black Community (3 credits)

Prerequisite: HIST255, AASP202, or AASP100; or permission of BSOS-African American Studies department.
Scientific knowledge and skills in solving technological and social problems, particularly those faced by the black community. Examines the evolution and development of African and African American contributions to science. Surveys the impact of technological changes on minority communities.

AASP 443 Blacks and the Law (3 credits)

Prerequisite: HIST255, AASP202, or AASP100; or permission of BSOS-African American Studies department.
The relationship between black Americans and the law, particularly criminal law, criminal institutions and the criminal justice system. Examines historical changes in the legal status of blacks and changes in the causes of racial disparities in criminal involvement and punishments.

AASP 468 Special Topics in Africa and the Americas (3 credits)

Repeatable to 6 credits if content differs.
Cultural, historical and artistic dimensions of the African experience in Africa and the Americas.

AASP 478 Humanities Topics in African American Studies (3 credits)

Repeatable to 6 credits if content differs.
Advanced studies in the humanities, often requiring prerequisites, focusing on the literary, artistic and philosophical contributions of Africans and African Americans.

AASP 483 Gender, Sexuality and the Black Family (3 credits)

Prerequisite: AASP100. Credit only granted for: AASP483 or AASP498F. Formerly: AASP498F.
Examining the historical, economic, social, and scholarly construction of African American family structures. The problematization of "Black matriarchy," hetero- and homosexuality, bi-racialism, and other efforts to "normalize" African Americans to conform to Eurocentric and religious concepts of family will be critically analyzed.

AASP 493 Feminist and Nationalist Thought in Black Communities (3 credits)

Prerequisite: AASP101 or AASP100. Credit only granted for: AASP493 or AASP499W. Formerly: AASP499W.
The historical and theoretical foundations of feminist and nationalist thought in Black Communities will be examined. Further, we will discover why feminist and nationalist thought has been routinely ignored or misrepresented as disparate, if not oppositional, themes in Black intellectual and political life.

AASP 498 Special Topics in Black Culture (3 credits)

Prerequisite: AASP202 or AASP100. Repeatable to 6 credits if content differs.
Advanced study of the cultural and historical antecedents of contemporary African and African American society. Emphasis on the social, political, economic and behavioral factors affecting blacks and their communities. Topics vary.

AASP 499 Advanced Topics in Public Policy and the Black Community (3 credits)

Prerequisite: AASP301; or permission of BSOS-African American Studies department. Repeatable to 6 credits if content differs.
Examination of specific areas of policy development and evaluation in black and other communities. Application of advanced tools of policy analysis, especially quantitative, statistical and micro-economic analysis.

AASP 602 Interdisciplinary Research Methods in Afro-American Studies (3 credits)

Restriction: Permission of BSOS-African American Studies department; or permission of EDUC-Education Policy and Leadership department.
The purpose of this course is to familiarize graduate students with both the interdisciplinary and multidisciplinary approaches that academics employ when producing scholarship in the field of Afro-American Studies. This will examine the contours of the field with an emphasis on work in both the social sciences and the arts and humanities.

AASP 611 Classic Texts and Contemporary Issues (3 credits)

Restriction: Permission of BSOS-African American Studies department.
Through a review and analysis of classic texts of Black intellectuals, artists, writers, and activists, students will examine the compelling themes in African American life and scholarship.

AASP 621 Public Policy and Black Communities (3 credits)

Restriction: Permission of BSOS-African American Studies department.
This course explores the role of race in social policy formation and emphasizes the importance of both political institutions and economic relations as determinants of the policy making process and context.

Asian American Studies (AAST)

AAST 420 Asian American Women: The Social Construction of Gender (3 credits)

Restriction: Must not have completed WMST420. Also offered as: WMST420. Credit only granted for: AAST420 or WMST420.
Examines the intersection of gender, race and class as it relates to Asian American women in the United States; how institutionalized cultural and social statuses of gender, race, ethnicity and social class produce and reproduce inequality with implications for Asian Americans and the broader society.

AAST 424 Sociology of Race Relations (3 credits)

Prerequisite: 6 credits in SOCY courses; or permission of UGST-Undergraduate Studies. Restriction: Must not have completed SOCY424. Also offered as: SOCY424. Credit only granted for: AAST424 or SOCY424.

Analysis of race-related issues, with a primary focus on American society. The historical emergence, development, and institutionalization of racism; the impact of racism on its victims; and racially based conflict.

AAST 443 Asian American Politics (3 credits)

Credit only granted for: AAST4898T, AAST443, GVPT368C or AMST 498J. Formerly: AAST 498T.

Students will gain a greater understanding of 1)the role of Asian Americans in US politics, 2) the political attitudes and behaviors of Asian Americans and 3)how to conduct research on Asian American politics. Though the class will concentrate on Asian Americans, issues related to Asian American politics will be examined within the larger context of America's multicultural political landscape.

AAST 498 Advanced Topics in Asian American Studies (3 credits)

Repeatable to 6 credits if content differs.

Advanced study of the cultural and historical antecedents of contemporary Asian American society. Emphasis on the social, political, economic, and behavioral factors affecting Asian Americans and their communities.

AAST 499 Senior Thesis (3 credits)

Prerequisite: AAST201 and AAST200. Restriction: Permission of UGST-Undergraduate Studies; and must be in Asian American Studies program. Repeatable to 6 credits if content differs.

Under the supervision of faculty, research regarding a specific topic of the Asian American experience will be completed.

Agriculture and Natural Resources (AGNR)

AGNR 400 International Agricultural Extension and Development (3 credits)

Formerly: AGRI400.

Examination of the social and ethical issues that shape extension's role in the agriculture sector of countries worldwide and that determine its contribution to international development. Review of a wide range of literature from scholars, governments, and international organizations.

AGNR 422 International Agriculture Science and Culture (6 credits)

Restriction: Permission of AGNR-College of Agriculture & Natural Resources.

Immersion-based, intensive course of study in a foreign agricultural education setting. UM Students will study with local students in a variety of University classes and field experiences in agriculture, natural resources and environmental sciences, laboratory science, economics, education technology, etc. Students will learn customs, culture and language of the host country.

AGNR 423 Exploring International Agriculture (3 credits)

Restriction: Permission of AGNR-College of Agriculture & Natural Resources; and must not have completed AGNR422.

Immersion-based, intensive course of study in a foreign agricultural setting. Students may expect to have university classes and field experiences in one or more agriculture and natural resource disciplines. Students will learn about the culture and customs of the host country as well as undertake at least an introductory language course.

AGNR 489 Field Experience (1-4 credits)

Restriction: Permission of AGNR-College of Agriculture & Natural Resources. Repeatable to 4 credits if content differs. Formerly: AGRI489.

Credit according to time scheduled and organization of the course. A lecture series organized to study in depth a selected phase of agriculture not normally associated with one of the existing programs.

AGNR 499 Special Problems (1-3 credits)

Formerly: AGRI499.

AGNR 606 Program Planning and Evaluation in Agricultural Education (2-3 credits)

Formerly: AGRI606.

Second semester. Analysis of community agricultural education needs, selection and organization of course content, criteria and procedures for evaluating programs.

AGNR 630 Teaching-Learning in Adult and Continuing Education (3 credits)

Formerly: AGRI630.

The teaching/learning process in adult continuing education. Instructional techniques and methodologies appropriate for adults. The curriculum development process. Issues and priorities in adult continuing education.

AGNR 661 Rural Community Analysis (3 credits)

Formerly: AGRI661.

Communities as social systems composed of organizations which interact in a system of cultural institutions, norms, and values. Functional and structural linkages between organizations within as well as outside the community; rural vs. urban similarities and differences; and the role of the social processes such as competition, cooperation and conflict in the context of community power and leadership structure.

AGNR 699 Special Problems (1-3 credits)

Formerly: AGRI699.

AGNR 789 Special Topics (1-3 credits)

Repeatable to 9 credits if content differs. Formerly: AGRI789.

AGNR 798 Seminar in Rural Education (1-3 credits)

Repeatable to 8 credits if content differs. Formerly: AGRI798.

Problems in the organization, administration, and supervision of the several agencies of rural and/or vocational education.

AGNR 799 Master's Thesis Research (1-6 credits)

Formerly: AGRI799.

AGNR 888 Apprenticeship in Education (1-8 credits)

Prerequisite: Must have completed 6 credits in Education at the University of Maryland. Restriction: Must have experience and must have a master's degree. Formerly: AGRI888.

Apprenticeships in the major area of study are available to selected students whose application for an apprenticeship has been approved by the education faculty. Each apprentice is assigned to work for at least a semester full-time or the equivalent with an appropriate agency. The sponsor of the apprentice maintains a close working relationship with the apprentice and the other persons involved.

AGNR 889 Internship in Education (3-8 credits)

Formerly: AGRI889.

Internships in the major area of study for experienced students who are assigned to an appropriate school system, educational institution, or agency in a situation different than that in which the student is regularly employed.

AGNR 899 Doctoral Dissertation Research (1-8 credits)
Formerly: AGRI899.

Agronomy (AGRO)

AGRO 789 Advances in Agronomy Research (1-4 credits)
Restriction: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 4 credits if content differs.
A study of recent advances in agronomy research.

Applied Mathematics & Scientific Computation (AMSC)

AMSC 420 Mathematical Modeling (3 credits)
Prerequisite: MATH240 or MATH461; and (MATH241, MATH246, and STAT400); and permission of CMNS-Mathematics department. Also offered as: MATH420. Credit only granted for: AMSC420 or MATH420.
The course will develop skills in mathematical modeling through practical experience. Students will work in groups on specific projects involving real-life problems that are accessible to their existing mathematical backgrounds. In addition to the development of mathematical models, emphasis will be placed on the use of computational methods to investigate these models, and effective oral and written presentation of the results.

AMSC 452 Introduction to Dynamics and Chaos (3 credits)
Prerequisite: MATH246 and MATH240. Also offered as: MATH452. Credit only granted for: AMSC452 or MATH452.
An introduction to mathematical dynamics and chaos. Orbits, bifurcations, Cantor sets and horseshoes, symbolic dynamics, fractal dimension, notions of stability, flows and chaos. Includes motivation and historical perspectives, as well as examples of fundamental maps studied in dynamics and applications of dynamics.

AMSC 460 Computational Methods (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241); and 1 course with a minimum grade of C- from (CMSC106, CMSC131). Also offered as: CMSC460. Credit only granted for: AMSC460, CMSC460, AMSC466, or CMSC466.
Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.

AMSC 466 Introduction to Numerical Analysis I (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241); and 1 course with a minimum grade of C- from (CMSC106, CMSC131). Also offered as: CMSC466. Credit only granted for: AMSC460, CMSC460, AMSC466, or CMSC466.
Floating point computations, direct methods for linear systems, interpolation, solution of nonlinear equations.

AMSC 498 Selected Topics in Applied Mathematics (1-3 credits)
Repeatable to 6 credits if content differs.
Topics in applied mathematics of special interest to advanced undergraduate students.

AMSC 600 Advanced Linear Numerical Analysis (3 credits)
Prerequisite: AMSC666 or CMSC666; or permission of instructor. Also offered as: CMSC760. Credit only granted for: AMSC600 or CMSC760.
Advanced topics in numerical linear algebra, such as dense eigenvalue problems, sparse elimination, iterative methods, and other topics.

AMSC 660 Scientific Computing I (3 credits)
Prerequisite: Must have knowledge of C or Fortran. And AMSC460 or CMSC460; or (CMSC466 or AMSC466); or (must have knowledge of basic numerical analysis (linear equations, nonlinear integration, interpolation); and permission of instructor). Also offered as: CMSC660. Credit only granted for: AMSC660 or CMSC660.
Monte Carlo simulation, numerical linear algebra, nonlinear systems and continuation method, optimization, ordinary differential equations. Fundamental techniques in scientific computation with an introduction to the theory and software of each topic.

AMSC 661 Scientific Computing II (3 credits)
Prerequisite: Must have knowledge of C or Fortran. And AMSC460 or CMSC460; or (CMSC466 or AMSC466); or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: CMSC661. Credit only granted for: AMSC661 or CMSC661.
Fourier and wavelet transform methods, numerical methods for elliptic partial differential equations, numerical linear algebra for sparse matrices. Finite element methods, numerical methods for tiem dependent partia l differential equations. Techniques for scientific computation with an introduction to the theory and software for each topic. Course is part of a two course sequence (660 and 661), but can be taken independently.

AMSC 662 Computer Organization and Programming for Scientific Computing (3 credits)
Prerequisite: Must have knowledge of C or Fortran. And AMSC460 or CMSC460; or (CMSC466 or AMSC466); or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: CMSC662. Credit only granted for: AMSC662 or CMSC662.
This course presents fundamental issues of computer hardware, software, parallel computing, and scientific data management for programming for scientific computation.

AMSC 663 Advanced Scientific Computing I (3 credits)
Prerequisite: CMSC660 or AMSC660; and (CMSC661 or AMSC661). Restriction: Permission of instructor. Also offered as: CMSC663. Credit only granted for: AMSC663 or CMSC663.
In the sequence AMSC663, AMSC664 students work on a year-long individual project to develop software for a scientific task in a high performance computing environment. Lectures will be given on available computational environments, code development, implementation of parallel algorithms.

AMSC 664 Advanced Scientific Computing II (3 credits)
Prerequisite: AMSC663. Restriction: Permission of instructor. Also offered as: CMSC664. Credit only granted for: AMSC664 or CMSC664.
In the sequence AMSC 663, AMSC 664 students work on a year-long individual project to develop software for a scientific task in a high performance computing environment. Lectures will be given on code development and validation, parallel algorithms for partial differential equations, nonlinear systems, optimization.

AMSC 666 Numerical Analysis I (3 credits)
Prerequisite: CMSC466 or AMSC466; and MATH410. Also offered as: CMSC666. Credit only granted for: AMSC666 or CMSC666.
Approximation theory, numerical solution of initial-value problems, iterative methods for linear systems, optimization.

AMSC 667 Numerical Analysis II (3 credits)
Prerequisite: AMSC666 or CMSC666. Also offered as: CMSC667. Credit only granted for: AMSC667 or CMSC667.
Numerical solution of initial value problems, numerical solution of boundary value problems, iterative methods for linear systems of equations, numerical methods for eigenvalue problems.

AMSC 670 Ordinary Differential Equations I (3 credits)
Prerequisite: MATH405. And MATH410; or students who have taken courses with comparable content may contact the department. Also offered as: MATH670. Credit only granted for: AMSC670 or MATH670.
Existence and uniqueness, linear systems usually with Floquet theory for periodic systems, linearization and stability, planar systems usually with Poincare-Bendixson theorem.

AMSC 671 Ordinary Differential Equations II (3 credits)
Prerequisite: MATH630. And MATH670 or AMSC670; or students who have taken courses with comparable content may contact the department. Also offered as: MATH671. Credit only granted for: AMSC671 or MATH671.
The content of this course varies with the interests of the instructor and the class. Stability theory, control, time delay systems, Hamiltonian systems, bifurcation theory, and boundary value problems.

AMSC 673 Partial Differential Equations I (3 credits)
Prerequisite: MATH411; or students who have taken courses with comparable content may contact the department. Also offered as: MATH673. Credit only granted for: AMSC673 or MATH673.
Analysis of boundary value problems for Laplace's equation, initial value problems for the heat and wave equations. Fundamental solutions, maximum principles, energy methods. First order nonlinear PDE, conservation laws. Characteristics, shock formation, weak solutions. Distributions, Fourier transform.

AMSC 674 Partial Differential Equations II (3 credits)
Prerequisite: MATH673 or AMSC673; or permission of instructor. Also offered as: MATH674. Credit only granted for: AMSC674 or MATH674.
Boundary value problems for elliptic partial differential equations via operator-theoretic methods. Hilbert spaces of functions. Duality, weak convergence. Sobolev spaces. Spectral theory of compact operators. Eigenfunction expansions.

AMSC 689 Research Interactions in Applied Mathematics and Scientific Computation (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
The students participate in a vertically integrated (undergraduate, graduate and/or postdoctoral, faculty) research group. Format varies, but includes regular meetings, readings and presentations of material. See graduate program's online syllabus or contact the graduate program director for more information.

AMSC 698 Advanced Topics in Applied Mathematics (1-4 credits)
Repeatable to 99 credits if content differs.

AMSC 699 Applied Mathematics Seminar (1-3 credits)
Repeatable to 99 credits if content differs.
Seminar to acquaint students with a variety of applications of mathematics and to develop skills in presentation techniques.

AMSC 714 Mathematics of the Finite Element Method (3 credits)
Prerequisite: Must have completed one semester graduate level course in partial differential equations; or permission of instructor. Credit only granted for: AMSC 714 or AMSC 614. Formerly: AMSC614.
Variational formulations of linear and nonlinear elliptic boundary value problems; formulation of the finite element method; construction of finite element subspaces; error estimates; eigenvalue problems; time dependent problems.

AMSC 715 Numerical Methods in Partial Differential Equations (3 credits)
Prerequisite: Must have completed one graduate level course in partial differential equations OR one theoretical graduate level course in an applied mathematics field; or permission of instructor. Credit only granted for: AMSC612 or AMSC715. Formerly: AMSC612.
Finite difference methods for elliptic, parabolic, and hyperbolic partial differential equations. Additional topics such as spectral methods, variational methods for elliptic problems, stability theory for hyperbolic initial-boundary value problems, and solution methods for conservation laws.

AMSC 760 Applied Statistics Practicum (3 credits)
Prerequisite: Must have completed one year of graduate study in Applied Statistics. Restriction: Must have project proposal approved by SAC coordinator.
A semester long applied applied statistical project (a minimum 10 hours per week or 120 hours in total), in an internship of collaborative research-laboratory setting working on a substantive applied quantitative project with significant statistical content.

AMSC 761 Applied Statistics Seminar (1 credits)
Recommended: STAT700 or STAT701; and (STAT740 or STAT741).
Seminar taught once yearly on a rotating basis by faculty engaged in the Applied Statistics area. Required of AMSC Applied Statistics area doctoral students within one year following the completion of their practicum project, AMSC760, and open only to Applied Statistics Area students. The seminar will include sessions on presentation skills, but will consist primarily of oral presentations of students' past Practicum project results. Students attend throughout the term, give one talk (at least 1/2 hour).

AMSC 762 Data Analysis Project (1 credits)
This course cannot be used to meet any of the Applied Statistics Area's seminar requirements. Offered yearly, required of and limited to MS non-thesis and doctoral students in Applied Statistics Area, for whom the resulting projects serve as a Qualifying Exam component. After 5-6 lectures or presentations on components of successful data analyses and write-ups, 3-4 sessions will discuss previous student project submissions. The culminating project, to be completed in a two week period between semesters, is an analysis and written report of one of three project choices made available each year to represent a spectrum of realistic applied statistical problems.

AMSC 764 Advanced Numerical Optimization (3 credits)
Prerequisite: MATH410; or permission of instructor. Also offered as: CMSC764. Credit only granted for: AMSC607, AMSC764 or CMSC764. Formerly: AMSC607.
Modern numerical methods for solving unconstrained and constrained nonlinear optimization problems in finite dimensions. Design of computational algorithms and the analysis of their properties.

AMSC 799 Master's Thesis Research (1-6 credits)

AMSC 808 Advanced Topics in Applied Mathematics (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

AMSC 819 Applied Mathematics Seminar (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

AMSC 898 Pre-Candidacy Research (1-8 credits)

AMSC 899 Doctoral Dissertation Research (1-8 credits)

American Studies (AMST)

AMST 418 Cultural Themes in America (3 credits)
Repeatable to 6 credits if content differs.
Examination of structure and development of American culture through themes such as "growing up American," "culture and mental disorders," "race," "ethnicity," "regionalism," "landscape," and "humor."

AMST 428 American Cultural Eras (3 credits)
Repeatable to 6 credits if content differs.
Investigation of a decade, period, or generation as a case study in significant social change within an American context. Case studies include "Antebellum America, 1840-1860" and "American culture in the Great Depression."

AMST 429 Perspectives on Popular Culture (3 credits)
Repeatable to 6 credits if content differs.
Topics in popular culture studies, including the examination of particular genres, themes, and issues.

AMST 432 Literature and American Society (3 credits)
Prerequisite: Must have completed 1 course in American Literature or 1 course in American History; or 1 course in SOCY; or 1 course in AMST.
Examination of the relationship between literature and society: including literature as cultural communication and the institutional framework governing its production, distribution, conservation and evaluation.

AMST 433 American Humor (3 credits)
Credit only granted for: AMST418A or AMST433. Formerly: AMST418A.
American humor from the Colonial era through the present in genres including literature, journalism, graphic arts, performance, and modern media. How humor expresses and mediates important social and cultural concerns including politics, religion, race and ethnicity, gender and topical issues.

AMST 450 Seminar in American Studies (3 credits)
Prerequisite: AMST201 and AMST340; and 1 course in AMST. Restriction: Senior standing; and must be in American Studies program.
Developments in theories and methods of American Studies scholarship, with emphasis upon interaction between the humanities and the social sciences in the process of cultural analysis and evaluation.

AMST 498 Special Topics in American Studies (3 credits)
Repeatable to 9 credits if content differs.
Topics of special interest.

AMST 499 Independent Studies (1-3 credits)
Restriction: Permission of ARHU-American Studies department; and must be in American Studies program. Repeatable to 6 credits if content differs.
Provides the student with the opportunity to pursue independent, interdisciplinary research and reading in specific areas of American culture studies.

AMST 601 Introductory Theories and History in American Studies (3 credits)
Restriction: Must not be a Graduate Advanced Special Student.
Explores the formative literature, theories, research approaches, and history of American Studies.

AMST 602 Interdisciplinary Research Methods and Bibliographic Instruction (3 credits)
Advanced instruction interdisciplinary research strategies, bibliography, and the structure of systems of scholarly communication in the fields and subfields of American Studies.

AMST 603 Current Approaches to American Studies (3 credits)
Restriction: Must be in one of the following programs (American Studies (Master's); American Studies (Doctoral)) . Or permission of ARHU-American Studies department; and permission of instructor.
Builds on AMST601 and explores contemporary literature, theory, and intellectual issues in American Studies.

AMST 628 Seminar in American Studies (3 credits)

AMST 629 Seminar in American Studies (3 credits)

AMST 638 Orientation Seminar: Material Aspects of American Civilization (3 credits)
Class meets at the Smithsonian.

AMST 639 Reading Course in Selected Aspects of American Civilization (3 credits)
Class meets at the Smithsonian.

AMST 650 Material Culture Studies Theory (3 credits)
Readings and analysis of canonical and current scholarly approaches to the study of material culture. Covers a wide range of material culture genres and subfields, and focuses on artifacts and the built environment.

AMST 655 Introduction to Museum Scholarship (3 credits)
Also offered as: HIST610, ANTH655. Credit only granted for: AMST655, ANTH655, or HIST610.
Provides students a basic understanding of museums as cultural and intellectual institutions. Topics include the historical development of museums, museums as resources for scholarly study, and the museum exhibition as medium for presentation of scholarship.

AMST 698 Directed Readings in American Studies (3 credits)
Repeatable to 6 credits if content differs.
This course is designed to provide students with the opportunity to pursue independent, interdisciplinary research and reading in specific aspects of American culture under the supervision of a faculty member.

AMST 798 Non-Thesis Research (1-3 credits)

AMST 799 Master's Thesis Research (1-6 credits)

AMST 801 Research Seminar in American Life and Culture (3 credits)
Prerequisite: Must have successfully completed two American Studies graduate readings seminars.
A research writing seminar that provides students with an opportunity to complete an original research project to gain

experience in related scholarly activities (proposing and configuring research and making conference-style presentation).

AMST 851 Interpretation of Cultural Landscapes (3 credits)
A research seminar that provides students an opportunity to survey the principal approaches to studying a cultural landscape, learn how to apply and adapt a field research method, and produce a primary research report on a cultural landscape of their choice.

AMST 856 Museum Research Seminar (3 credits)
Prerequisite: AMST655. Also offered as: ANTH856, HIST810. Credit only granted for: AMST856, HIST810, or ANTH856.
A research seminar focusing on the practice and presentation of cultural and historical scholarship in museums and historical sites. Students will complete an original research project on the challenges and opportunities of public exhibition and interpretation of cultural and historical research.

AMST 857 Museum Scholarship Practicum (3-6 credits)
Prerequisite: AMST856; and permission of Museum Scholarship Program required. Also offered as: ANTH857, HIST811. Credit only granted for: AMST857, ANTH857, or HIST811.
Students devise and carry out a research program using the collections at the Smithsonian Institution or some other cooperating museum, working under joint supervision of a museum professional and a university faculty member.

AMST 878 American Studies Pedagogy Mentoring (1-3 credits)
Restriction: Must be an AMST graduate assistant. Repeatable to 12 credits.
This course provides graduate teaching assistants with a structured approach to pedagogical content, techniques, and collaborative practices that they learn and then can use throughout their careers. It also commits a core faculty member to teaching pedagogy and makes it possible for the course to become a formal part of one's load.

AMST 898 Pre-Candidacy Research (1-8 credits)

AMST 899 Doctoral Dissertation Research (1-8 credits)

Animal Science (ANSC)

ANSC 420 Critical Thinking in Animal Science (3 credits)
Prerequisite: ANSC314. Recommended: AREC306 and AREC250. Restriction: Junior standing or higher.
Employ methods to systematically solve selected problems that typically arise on farms or allied businesses related to animal enterprises.

ANSC 435 Experimental Embryology (3 credits)
Prerequisite: ANSC212. Recommended: Completion of one course in reproductive physiology is recommended. Credit only granted for: ANSC435 or ANSC489M. Formerly: ANSC489M.
Experimental approaches to mammalian embryology with emphasis on domestic livestock systems as applied to research and production systems. Lab will include hands-on experiments and demos of in vitro embryo production, embryo splitting, cell injection and nuclear transfer.

ANSC 437 Animal Biotechnology (3 credits)
Prerequisite: ANSC327; or students who have taken courses with comparable content may contact the department.
Key concepts and current issues in animal biotechnology are covered. Current techniques and applications systems as well as social, ethical, and regulatory issues associated with biotechnology will be discussed.

ANSC 440 Zoonotic Diseases and Control (3 credits)
Prerequisite: BSCI223, ANSC212, ANSC327, BSCI222, BSCI421, or NFSC430; or students who have taken courses with comparable content may contact the department. Credit only granted for: ANSC440 or ANSC489R. Formerly: ANSC489R.
Global perspective of foodborne diseases common to animals and man, specifically those caused by farm animal-originated human pathogens (zoonoses) and their control. A selection of important zoonoses and food safety issues will be specifically covered with an emphasis on the principles of zoonotic disease transmission and control, risk factors to humans, and surveillance methods.

ANSC 443 Physiology of Lactation (3 credits)
Prerequisite: CHEM231, ANSC212, and CHEM232. Recommended: BCHM463.
A comprehensive survey of lactation in laboratory and domestic animals. Other species are discussed where possible. Emphasis will be placed on physiological aspects of milk synthesis and secretion and on the cellular and molecular biology of mammary gland development.

ANSC 444 Domestic Animal Endocrinology (3 credits)
Prerequisite: ANSC212; or permission of instructor. Restriction: Must not have completed ANSC644. Credit only granted for: ANSC489I, ANSC444, or ANSC644. Formerly: ANSC489I.
Current developments in endocrinology as it relates to animals used in the production of food and other products important to the well being of humans will be covered.

ANSC 446 Physiology of Mammalian Reproduction (3 credits)
Prerequisite: ANSC212 or BSCI440.
Anatomy and physiology of reproductive processes in domesticated and wild mammals.

ANSC 447 Physiology of Mammalian Reproduction Laboratory (1 credits)
Prerequisite: Must have completed or be concurrently enrolled in ANSC446.
Gross and micro-anatomy, artificial insemination, estrous cycle synchronization and invitro-fertilization procedures and analytical techniques useful in animal management and reproduction.

ANSC 450 Animal Breeding Plans (3 credits)
Prerequisite: BIOM301; or students who have taken courses with comparable content may contact the department. Restriction: Junior standing or higher.
Design of animal breeding programs for the genetic improvement of livestock and companion animal species. Principles of population and quantitative genetics. Genetic evaluations of animals, selection strategies and crossbreeding systems. Incorporation of advanced statistics and biotechnology into animal breeding plans.

ANSC 452 Avian Physiology (3 credits)
Prerequisite: ANSC212. Restriction: Junior standing or higher.
The digestive, excretory, respiratory, circulatory, immune, skeletal muscle, endocrine and nervous systems of avian species will be examined.

ANSC 453 Animal Welfare and Bioethics (3 credits)
Prerequisite: ANSC101 and ANSC103; or BSCI106; or permission of instructor. Restriction: Junior standing or higher.
Ethical concerns related to the use of animals in modern society. Historical and philosophical overview of animal welfare and bioethics. Applied ethical discussions on human/animal interrelationships, physical and genetic manipulation, and other current issues associated with the treatment of animals used in food production, research, zoos, and as pets.

ANSC 455 Applied Animal Behavior (3 credits)
Prerequisite: ANSC101 and ANSC103; or BSCI106.
Principles of animal behavior applied to production systems in animal agriculture.

ANSC 460 Comparative Vertebrate Immunology (3 credits)
Prerequisite: ANSC212, BSCI201, or BSCI440. Credit only granted for: ANSC460 or ANSC489I. Formerly: ANSC489I.
Basic concepts in immunology, and comparing immunity in different vertebrates, including organization of immune systems, innate and adaptive immune responses. Special attention will be paid to how cell-mediated and humoral immune responses are induced in natural infections, and what are the effector mechanisms in both of these processes. Immune response in representative disease models such as infections with viruses and bacteria, cancer, and autoimmune disease will be discussed. Lectures concerning cutting-edge research will also be given.

ANSC 489 Current Topics in Animal Science (1-3 credits)
Repeatable to 6 credits if content differs.
Examination of current developments in the animal sciences.

ANSC 497 Animal Biotechnology Recombinant DNA Laboratory (3 credits)
Prerequisite: ANSC327; or students who have taken courses with comparable content may contact the department. Recommended: ANSC437 and ANSC435.
An advanced course offering hands-on experience in performing recombinant DNA experiments. Current molecular biology techniques used for cloning genes, analyzing the gene products, and modifying the genes of animals will be performed. Techniques include isolation of DNA, use of restriction enzymes; cloning procedures, PCR analysis, and Southern hybridizations. Lecture material focuses on interpretation of results generated in the laboratory.

ANSC 612 Energy Nutrition (3 credits)
Prerequisite: BCHM461 and NFSC450; or permission of instructor.
Advanced study of nutritional energetics in animals including humans, domestic animals and wildlife. Discussion of techniques used in energy metabolism research and factors affecting energy intake, absorption, utilization and deposition. Dietary guidelines and systems for describing energy requirements.

ANSC 617 Quantative Techniques in Physiology and Nutrition (3 credits)
Prerequisite: MATH220; or permission of AGNR-Animal & Avian Sciences department.
Development and evaluation of quantative techniques to explore mechanisims of physiological and nutritional regulation. Kinetic and dynamic models will be emphasized.

ANSC 627 Molecular and Quantitative Genetics (3 credits)
Classical, molecular, and population genetics with specific emphasis on animal systems will be covered. Also, disseminate information on molecular approaches for manipulating genetics at the whole animal level (transgenic and cloning). Other model organisms will be discussed to provide a conceptual framework.

ANSC 644 Molecular and Cellular Endocrinology (3 credits)
Restriction: Must not have completed ANSC444. Credit only granted for: ANSC444,ANSC489I, ANSC644, or ANSC688I. Formerly: ANSC688I.
A comprehensive course covering the major endocrine systems in animals. Lecture topics include major endocrine axes, hormonal regulation of homeostasis, growth and reproduction, and endocrine mechanisms of action. Advanced concepts in the molecular and cell biology of hormone action and regulation addressed in weekly discussion sessions centered on current research publications in the field of molecular and cellular endocrinology.

ANSC 660 Poultry Literature (1-4 credits)
Readings on individual topics are assigned. Written reports required. Methods of analysis and presentation of scientific material are discussed.

ANSC 688 Special Topics (1-4 credits)
Repeatable to 4 credits.
Lectures, experimental courses, and other special subjects in the fields of animal sciences and veterinary medicine.

ANSC 698 Seminar (1 credits)
Students are required to prepare papers based upon current scientific publications relating to animal science, or upon their research work, for presentation before and discussion by the class; (1) recent advances; (2) nutrition; (3) physiology; (4) biochemistry.

ANSC 699 Special Problems in Animal Science (1-2 credits)
Work assigned in proportion to amount of credit. Prerequisite: approval of staff. Problems will be assigned which relate specifically to the character of work the student is pursuing.

ANSC 799 Master's Thesis Research (1-6 credits)

ANSC 898 Pre-Candidacy Research (1-8 credits)

ANSC 899 Doctoral Dissertation Research (1-8 credits)

Anthropology (ANTH)

ANTH 410 Theory and Practice of Health and Community Development (3 credits)
Restriction: Junior standing or higher. Also offered as: ANTH610. Credit only granted for: ANTH410 or ANTH610.
Introduction to the relationships between culture, health status and practices, and the design of community-based initiatives. The focus is on the use of anthropological knowledge and skills in the analysis of such relationships and in the design of community-based initiatives.

ANTH 421 Nutritional Anthropology (3 credits)
Also offered as: ANTH621. Credit only granted for: ANTH421, ANTH428N, or ANTH621. Formerly: ANTH428N.
The study of nutrition from an anthropological perspective which includes both biological and cultural aspects of nutrition. We will explore how nutrition can affect culture how culture can affect nutrition. Nutritional anthropology includes the study of cross-cultural variation in diet, nutritional status and subsistence systems as well as variation in these factors over the evolutionary course of human existence, from prehistoric and historic to modem times. Students will be introduced to nutritional anthropology and provided with the basics for assessing reliability and feasibility of nutritional advice and policy encountered in everyday modern life in a global setting.

ANTH 422 Human-Plant-(Human & Bioactive Plant) Interaction (3 credits)
Prerequisite: ANTH220 and ANTH320; or permission of BSOS-Anthropology department. Credit only granted for: ANTH422. Formerly: ANTH428I.
This seminar course will discuss the evolutionary, historical, cultural, and ecological aspects of coevolution with respect to humans and their interactions with specific bioactive plants. Case studies of human- plant-(pathogen) interactions will be discussed as well as an inclusive survey of anthropologically

important phytochemicals. The seminar incorporates human-plant-(pathogen) interactions into models of human evolution and ecology.

ANTH 428 Special Topics in Bioanthropology (3 credits)

Repeatable to 6 credits if content differs.

Advanced research courses in biological anthropology on changing topics that correspond to new theoretical interests, faculty research interests, or the specialties of visiting scholars. Prerequisites or background knowledge vary with the topic. Check with the department for requirements.

ANTH 429 Advanced Special Topics in Biological Anthropology (3 credits)

Repeatable to 6 credits if content differs.

Upper level biological anthropology courses on varying topics derived from new interests of the faculty or the specialties of visiting scholars.

ANTH 438 Special Topics in Study Abroad IV (1-6 credits)

Repeatable to 15 credits if content differs.

Special topics course taken as part of an approved study abroad program.

ANTH 440 Theory and Practice of Historical Archaeology (3 credits)

Prerequisite: ANTH240. Also offered as: ANTH640. Credit only granted for: ANTH440 or ANTH640.

Historical archaeology enhances cultural heritage by providing voice for groups who were often unable to record their own histories, such as women, laborers, working class families, and enslaved people. The course provides insight into issues related to race, gender, and ethnicity as they relate to multicultural histories.

ANTH 441 Archaeology of Diaspora (3 credits)

Prerequisite: ANTH240. Credit only granted for: ANTH448A, ANTH688Z, or ANTH441. Formerly: ANTH448A.

"Diaspora" is defined, theorized, deconstructed, and employed throughout the social sciences. There are context specific relations that define who leaves, when, and how they are received in the new place of settlement. Over the course of the semester the class will actively and critically examine the relevance of historical archaeology and material culture studies in the understanding of the formation, experiences, and transformation of diasporic groups over time and space.

ANTH 442 Public Archeology (3 credits)

Credit only granted for: ANTH442, ANTH448V, or ANTH642. Formerly: ANTH448V.

Explores the uses and environments for archaeological work through a discussion of museum, electronic media, heritage settings, outdoor history museums, including the legal environment that offers protection for archaeological remains. The course exposes students to the majority of cultural media within which archaeology is currently practiced. The interdisciplinary course is a survey of the progress made within and beyond anthropology in understanding the function of heritage, public memory, tourism, and the other popular uses of materials from the past, including the progress made in linguistics psychology and other cognitive disciplines in understanding the purpose of the past.

ANTH 444 Theories of the Past (3 credits)

Prerequisite: ANTH240. Also offered as: ANTH740. Credit only granted for: ANTH448P, ANTH444, or ANTH740. Formerly: ANTH448P.

The primary purpose is to highlight some of the key achievements made by archaeologists in informing questions of interest to society from 1850 on. Key achievements include how archaeologists understand elements of the past thought to be central to the development of modern socieity. A secondary purpose is to introduce students to the theories used to understand the place of the past in society and the function of answers to questions thought central to modern social life.

ANTH 445 Laboratory Methods in Archaeology (3 credits)

Prerequisite: ANTH496. Recommended: ANTH240.

The processing, curation, cataloging and analysis of data is an important part of any archaeology field project. Students will learn that basics of laboratory techniques necessary for the final analysis and interpretation of field data.

ANTH 446 Chesapeake Archeology (3 credits)

Prerequisite: ANTH240. Credit only granted for: ANTH446, ANTH448W, ANTH646, or ANTH689W. Formerly: ANTH448W.

An overview of the culture and history of the Chesapeake watershed region, and of the issues that archaeologists face working in this region.

ANTH 447 Material Culture Studies in Archaeology (3 credits)

Prerequisite: ANTH240. Credit only granted for: ANTH447, ANTH448C, ANTH647, or ANTH689C. Formerly: ANTH448C.

An in-depth introduction to the world of material culture studies with a focus on the methods and theories in historical archaeology. Students will look at archaeological data as historical documents, commodities and as symbols expressing ideas.

ANTH 448 Special Topics in Archaeology (3 credits)

Prerequisite: ANTH240. Repeatable to 6 credits if content differs.

Advanced topics in archaeological research, corresponding to new theoretical developments, faculty research interests, or specialties of visiting scholars. Prerequisites may vary with course topic; check with the department for requirements.

ANTH 449 Advanced Special Topics in Archaeology (3 credits)

Repeatable to 6 credits if content differs.

Upper level archaeology courses on varying topics derived from new interests of the faculty or the specialties of visiting scholars.

ANTH 450 Theory and Practice of Environmental Anthropology (3 credits)

Restriction: Junior standing or higher. Also offered as: ANTH650. Credit only granted for: ANTH450 or ANTH650.

An overview of contemporary application of cultural theory and methods to environmental problems. Topics include the use of theories of culture, cognitive approaches, discourse analysis, and political ecology. Case studies from anthropology, other social sciences, humanities, conservation, and environmental history are used to demonstrate the applied value of a cultural-environmental approach.

ANTH 451 Environmental Archaeology (3 credits)

Credit only granted for: ANTH451, ANTH651, ANTH448F, ANTH668F. Formerly: ANTH448F.

An overview of modern environmental archaeology as a tool for the interdisciplinary investigation of past and present global change and to engage the long term past with current issues of sustainability and rapid environmental change.

ANTH 453 Archaeology of the Modern City (3 credits)

Prerequisite: ANTH240; or permission of instructor. Credit only granted for: ANTH448Q or ANTH453. Formerly: ANTH448Q.

An overview of how social scientists, in particular historical archaeologists, approach modern cities as being part of the materiality of the social structure and order.

ANTH 454 Anthropology of Travel and Tourism (3 credits)
Also offered as: ANTH654. Credit only granted for: ANTH454 or ANTH654.
Review of recent anthropological contributions to the study of travel and tourism development. Topics include the history of travel, political economy of tourism, gender in tourism, the built environment, ecotourism, and heritage tourism.

ANTH 462 Amazon Through Film (3 credits)
Credit only granted for: ANTH468D or ANTH462. Formerly: ANTH468D.
An interdisciplinary course that utilizes film to consider the Amazon basin, its history, peoples, and landscapes through cinematic representations. The course places the films in the context of film history and critical theory. The course takes into consideration the Brazilian, North American, Mexican, European and Argentine creators of the films and their visions of Amazonia, as well as the audiences and markets to which the films are intended.

ANTH 468 Special Topics in Cultural Anthropology (3 credits)
Repeatable to 6 credits if content differs.
Advanced courses in varying specialty areas of cultural anthropology that respond to new theoretical developments, faculty research interests, or specialties of visiting scholars.

ANTH 469 Advanced Special Topics in Cultural Anthropology (3 credits)
Repeatable to 6 credits if content differs.
Upper level cultural anthropology courses on varying topics derived from new interests of the faculty or the specialties of visiting scholars.

ANTH 472 Medical Anthropology (3 credits)
Credit only granted for: ANTH472, ANTH468, ANTH672, or ANTH688L. Formerly: ANTH468L.
An exploration of the cultural, social, economic and political dimensions of health, disease, and illness. These dimensions will be examined through both the health-seeker's and the care-provider's perspectives.

ANTH 476 Senior Research (3-4 credits)
Restriction: Must be in Anthropology program. Credit only granted for: ANTH476 or ANTH486.
Capstone course in which students pursue independent research into a current problem in anthropology, selected with assistance of a committee of faculty. Research leads to the writing of a senior thesis in anthropology.

ANTH 477 Senior Thesis (3-4 credits)
Prerequisite: ANTH476. Restriction: Permission of BSOS-Anthropology department; and must be in Anthropology program. Credit only granted for: ANTH477 or ANTH487.
Capstone course in which students write a senior thesis on independent research into a current problem in anthropology. The thesis is defined before a committee of faculty.

ANTH 478 Special Topics in Linguistics (3 credits)
Recommended: LING200. Repeatable to 6 credits if content differs.
Advanced courses in specialty areas that respond to new theoretical developments and faculty research interests in linguistics.

ANTH 486 Honors Research (3-4 credits)
Restriction: Permission of BSOS-Anthropology department; and must be in Anthropology program; and must be admitted to University Honors Program or Anthropology Honors Program. Credit only granted for: ANTH486 or ANTH476.
Capstone course in which students pursue independent research into a current problem in anthropology, selected with assistance of a committee of faculty. Research leads to the writing of an honors thesis in anthropology.

ANTH 487 Honors Thesis (3-4 credits)
Prerequisite: ANTH486. Restriction: Permission of BSOS-Anthropology department; and must be in Anthropology program; and must be admitted to University Honors Program or Anthropology Honors Program. Credit only granted for: ANTH487 or ANTH477.
Capstone course in which students write a thesis on the results of independent research into a current problem in anthropology.

ANTH 491 Applied Urban Ethnography (3 credits)
Prerequisite: ANTH260. Also offered as: ANTH617. Credit only granted for: ANTH468B, ANTH491, or ANTH617. Formerly: ANTH468B.
The focus is on the use of applied ethnographic field methods in community assessment research in urban settings. Also, it will extend beyond most ethnographic training in which the emphasis is on being there, and relying predominantly on the classical ethnographic methods of recursive observations, participant observations, and a variety of approaches to interviewing.

ANTH 492 Anthropology of the Immigrant Life Course (4 credits)
Credit only granted for: ANTH498N, ANTH492, ANTH689N, or ANTH692. Formerly: ANTH498N.
Explores social issues affecting local immigrant populations through readings, research and service learning. Theorizing immigration as a social policy issue in the U.S. culture, students learn about the specific contributions that anthropology has made to the understanding of immigration: globalization on the one hand, and the context of daily life in local neighborhoods on the other.

ANTH 493 Anthropological Fieldwork and Experience in Argentina: The Relevance of Context and Place (3 credits)
Credit only granted for: ANTH493, ANTH468Q, ANTH688Q, ANTH693, CPSP379, or HONR348E.
A three week intensive course in Argentina that examines anthropological fieldwork and experiences to understand the relevance of context and place in the identification and implementation of projects on health, development, and heritage. Students will learn to contextualize the production and dissemination of knowledge within political-economic, historical, socio-cultural and policy realms. Participant-observation of the local culture and exposure to the regional varieties of anthropological practice will also be carried out through comparison of projects in the U.S. and Argentina, visits to selected sites of anthropological production, and homestays with families.

ANTH 496 Field Methods in Archaeology (6 credits)
Field training in the techniques of archaeological survey and excavation.

ANTH 498 Advanced Field Training in Ethnography (1-8 credits)
Repeatable to 6 credits if content differs. Credit only granted for: ANTH498 or ANTH698.
Experience in field research utilizing a variety of ethnographic methods of inquiry.

ANTH 499 Fieldwork in Biological Anthropology (3-8 credits)
Field training in techniques of human biology, primatology, or paleoanthropology.

ANTH 601 Applied Anthropology (3 credits)
An overview of the history and current practices of applied anthropology. This

includes relationships between applied anthropology and other major subfields of the profession; the interdisciplinary and public context of applied anthropology; and problems of significance, utility, and ethics associated with applied anthropology.

ANTH 606 Qualitative Methods in Applied Anthropology (3 credits)
An introduction to the use of ethnography and qualitative methods in applied and policy contexts. Qualitative methods discussed include informal and systematic approaches. Students undertake fieldwork in local settings to practice the qualitative methods and to develop analysis and report writing skills.

ANTH 610 Advanced Studies in Theory and Practice of Health and Community Development (3 credits)
Also offered as: ANTH410. Credit only granted for: ANTH610 or ANTH410.
Introduction to the relationships between culture, health status and practices, and the design of community-based initiatives. The focus is on the use of anthropological knowledge and skills in the analysis of such relationships and in the design of community-based initiatives.

ANTH 612 Ethnology of the Immigrant Life (3 credits)
Credit only granted for: ANTH612 or ANTH698B.
Explores the soical issues affecting local immigrant populations through research and service learning components. Questions addressed include barriers to immigrant access to basic and social needs. What are the major characteristics of contemporary immigrants to neighborhoods adjacent to campus? How has this immigrant stream affected non-immigrant populations?

ANTH 615 The Anthropology of the African American Family (3 credits)
Credit only granted for: ANTH468N, ANTH618, or ANTH688N.
Suveys the African American family from a historical and ecological perspective, exploring adaptive responses through high stress periods. A key question underlying the explorations in this seminar is whether there are lessons from earlier African American organiztional structures (family, church, and community) that might be applicable to black families overcoming more recent periods of high environmental stress, or does such a concept even have relevance in today's multicultural world?

ANTH 617 Applied Urban Ethnography: Community Assessment Research (3 credits)
Also offered as: ANTH491. Credit only granted for: ANTH468B, ANTH617, or ANTH688B.
Explores the use of ethnographic research methods in carrying out community assessment research to inform the design, implementation, and evaluation of culturally and community appropriate community-based initiatives. This course usually has a fieldwork component in a local urban neighborhood.

ANTH 629 Advanced Developments in Biological Anthropology (3 credits)
Restriction: Permission of BSOS-Anthropology department. Credit only granted for: ANTH429 or ANTH629.
Graduate biological anthropology courses on varying topics derived from new interests of the faculty or the specialties of visiting scholars.

ANTH 630 Quantification and Statistics in Applied Anthropology (3 credits)
Restriction: Must be in one of the following programs (Anthropology (Doctoral); Anthropology (Master's)).
An intensive overview of key quantitative and statistical approaches used by social scientists in applied ad policy research. This includes nonparametric and parametric statistical approaches. Students utilize statistical software and analyze existing and student-created databases. Anthropological case studies are emphasized.

ANTH 640 Advanced Studies in Theory and Practice of Historical Archaeology (3 credits)
Also offered as: ANTH440. Credit only granted for: ANTH440 or ANTH640.
Historical archaeology enhances cultural heritage by providing voice for groups who were often unable to record their own histories, such as women, laborers, working class families, and enslaved people. The course provides insight into issues related to race, gender, and ethnicity as they relate to multicultural histories.

ANTH 642 Advanced Studies in Public Archaeology (3 credits)
Explores the uses and environments for archaeological work through a discussion of museum, electronic media, heritage settings, outdoor history museums, including the legal environment that offers protection for archaeological remains. The course exposes advanced graduate students to the majority of the cultural media within which archaeology is currently practiced. The interdisciplinary course is a survey of the progress made within and beyond anthropology in understanding the function of heritage, public memory, tourism, and the other popular uses of material from the past, including the progress made in linguistics and psychology, and other cognitive disciplines in understanding the purpose of the past.

ANTH 643 Anthropological Approaches to Geographic Information Science (3 credits)
Credit only granted for: ANTH448S, ANTH643, or ANTH689S.
A practical introduction to GIS program use, including the production of archaeological and other maps, profiles, and integrated presentations of plans, photographs, texts, an other digitally available materials, as well as research applications in applied biological and cultural anthropology.

ANTH 646 Advanced Studies in Chesapeake Archaeology (3 credits)
Credit only granted for: ANTH448W, ANTH646, or ANTH689W. Formerly: ANTH689W.
An understanding of the greater Chesapeake region, including its major cities, derived from prehistoric and historical archaeology. The course will include topics related to the past and present conditions of Native peoples, colonized populations, and the relationship of preserved remains to modern political standings.

ANTH 647 Advanced Material Culture Studies in Archaeology (3 credits)
Credit only granted for: ANTH447, ANTH448C, ANTH647, or ANTH689C. Formerly: ANTH689C.
An in-depth introduction to the world of material culture studies with a focus on the methods and theories in historical archaeology. Students will look at archaeological data as historical documents, commodities and as symbols expressing ideas.

ANTH 649 Advanced Developments in Archaeology (3 credits)
Restriction: Permission of BSOS-Anthropology department. Repeatable to 6 credits if content differs.
Graduate Archaeology courses on varying topics derived from new interests of the faculty or the specialties of visiting scholars.

ANTH 650 Advanced Studies in Theory and Practice of Environmental Anthropology (3 credits)
Also offered as: ANTH450. Credit only granted for: ANTH450 or ANTH650.
An overview of contemporary application of cultural theory and methods to environmental problems. Topics include the use of theories of culture, cognitive approaches, discourse analysis, and political ecology. Case studies from anthropology, other social sciences,

humanities, conservation, and environmental history are used to demonstrate the applied value of a cultural-environmental approach.

ANTH 651 Environmental Archaeology (3 credits)
Credit only granted for: ANTH448F, ANTH451, ANTH688F, or ANTH651. Formerly: ANTH688F.
An overview of modern environmental archaeology as a tool for the interdisciplinary investigation of past and present global change and to engage the long term past with current issues of sustainability and rapid environmental change.

ANTH 654 Travel and Tourism (3 credits)
Also offered as: ANTH454. Credit only granted for: ANTH454 or ANTH654. Formerly: ANTH688U.
Review of recent anthropological contributions to the study to tourism and tourism development. Topics include the political economy of tourism, gender in tourism, the built environment, ecotourism, and sustainable tourism development.

ANTH 655 Introduction to Museum Scholarship (3 credits)
Also offered as: AMST655, HIST610. Credit only granted for: ANTH655, AMST655, or HIST610.
Provides students a basic understanding of museums as cultural and intellectual institutions. Topics include the historical development of museums, museums as resources for scholarly study, and the museum exhibition as medium for presentation of scholarship.

ANTH 656 Community-Based Tourism (3 credits)
Credit only granted for: ANTH468Y, ANTH688Y, or ANTH656.
Review of the global, economic, and representational properties of modern tourism development that threaten local self-determination. Questions addressed include how do communities cope with tourism and what are effective strategies for community-based and sustainable tourism development?

ANTH 657 Anthropology of Museums (3 credits)
Contemporary museums serve as repositories of knowledge, but are also en gaged with communities in the utilization and production of such knowledge. New venues to increase and enhance utilization are virtual galleries, community museums, and cultural centers. This course will include exhibit curation, public program planning, and implementation as museum practices that emerge from the theoretical framework of the new museology. The course will emphasize the cross disciplinary nature of museum work.

ANTH 669 Advanced Developments in Cultural Anthropology (3 credits)
Restriction: Permission of BSOS-Anthropology department. Repeatable to 6 credits if content differs.
Graduate cultural anthropology courses on varying topics derived from new interests of the faculty or the specialties of visiting scholars.

ANTH 670 Current Developments in Anthropological Theory (3 credits)
Credit only granted for: ANTH470 or ANTH670.
A review of major contributions to anthropological theory, with a special emphasis on the relationship between practice and theory. Includes use of concept of culture in the four traditional subfields, fieldwork and grounded theory, and significant advances in general theory, symbolic anthropology, critical theory, and postmodernism.

ANTH 672 Advanced Studies in Medical Anthropology (3 credits)
Credit only granted for: ANTH472, ANTH468L, ANTH672, or ANTH688L. Formerly: ANTH688L.
An exploration of the cultural, social, economic and political dimensions of health, disease, and illness. These dimensions will be examined through both the health-seeker's and the care-provider's perspectives.

ANTH 688 Current Developments in Anthropology (3 credits)
Repeatable to 9 credits if content differs.
Detailed investigation of a current problem or research technique, the topic to be chosen in accordance with faculty interests and student needs.

ANTH 689 Special Problems in Anthropology (1-6 credits)

ANTH 692 Anthropology of the Immigrant Life Course (4 credits)
Also offered as: ANTH492. Credit only granted for: ANTH 492, ANTH692, ANTH498N, ANTH689N. Formerly: ANTH689N.
Explores social issues affecting local immigrant populations through readings, research and service learning. Theorizing immigration as a social policy issue in the U.S. culture, students learn about the specific contributions that anthropology has made to the understanding of immigration: globalization on the one hand, and the context of daily life in local neighborhoods on the other.

ANTH 693 Advance Studies in Anthropological Fieldwork and Experiences in Argentina: The Relevance of Context and Place (3 credits)
Credit only granted for: ANTH493, ANTH688Q, ANTH693, CPSP379, or HONR348E.
A three week intensive course in Argentina that examines anthropological fieldwork and experiences to understand the relevance of context and place in the identification and implementation of projects on health, development, and heritage. Students will learn to contextualize the production and dissemination of knowledge within political-economic, historical, socio-cultural and policy realms. Participant-observation of the local culture and exposure to the regional varieties of anthroplogical practice will also be carried out through comparison of projects in the U.S. and Argentina, visits to selected sites of anthropological production, and homestays with families.

ANTH 696 Field Methods in Archaeology (6 credits)
Formerly: ANTH699.
Field training in the techniques of archaeological survey and excavation.

ANTH 698 Advanced Field Training in Ethnology (1-6 credits)
Repeatable to 6 credits if content differs. Credit only granted for: ANTH498 or ANTH698.
Experience in field research utilizing a variety of enthnographic methods of inquiry.

ANTH 701 Anthropology Internship Preparation (3 credits)
Preparation for internship includes practicum training in development, presentation and evaluation of position papers, proposals and work plans; literature search and use of secondary data sources in decision making the effect cultural analysis and resource management; ethics and professional development for work in non-academic settings.

ANTH 712 Anthropology Internship Analysis (3 credits)
Prerequisite: ANTH789.
The preparation and presentation of internship results, and the development of skills in report writing and presentation. Includes the completion of a professional quality report or publishable paper based on the internship experience.

ANTH 720 Advanced Studies in Theory and Practice in Applied Biological Anthropology (3 credits)

Credit only granted for: ANTH420, ANTH425, ANTH625, or ANTH720.
An introductin to the major theoretical and methodological underpinngs of applied biological anthropology within such areas as anthropological genetics, applied anthropometry, forensic anthropology, museum studies, and zoological parks. Emphasis is on the evaluation of the contributions of applied bioanthropological studies to particular problems in human health, environment, and heritage.

ANTH 722 Ecological Anthropology (3 credits)

Restriction: Must be in one of the following programs (Anthropology (Doctoral); Anthropology (Master's)). Credit only granted for: ANTH720 or ANTH722.
An overview of important approaches to ecological anthropology. Population, systems, community, political, behavioral and evolutionary ecology will be examined as they have been applied to a range of anthropological questions. Complexity theory (nonlinear dynamics) and topics in game theory will also be addressed. Students will map the field of ecological anthropology and to assess the strengths and weaknesses of contemporary approaches, methods and theories.

ANTH 740 Theories of the Past and Accomplishments of Archaeology (3 credits)

Credit only granted for: ANTH689P or ANTH740. Formerly: ANTH689P.
The primary purpose is to highlight some of the key achievements made by archaeologists in informing questions of interest to society from 1850 on. Key achievements include how archaeologists understand elements of the past thought to be central to the development of modern socieity. A secondary purpose is to introduce students to the theories used to understand the place of the past in society and the function of answers to questions thought central to modern social life.

ANTH 760 Development of Social/Cultural Theory (3 credits)

A broad perspective of the history of social cultural theory in anthropology and the critical skills needed for understanding the subdiscipline is provided. An overview of the history of theorizing about society and culture will help outline the past, present, and future of anthropology and its relations with other scientific and humanistic disciplines.

ANTH 788 Internship Research (1-3 credits)

Prerequisite: ANTH701. Restriction: Permission of BSOS-Anthropology department; and must be in one of the following programs (Anthropology (Master's); Anthropology (Doctoral)).
This course augments ANTH 789 and is graded in conjunction with it.

ANTH 789 Internship (3-6 credits)

Prerequisite: ANTH701. Repeatable to 6 credits if content differs. Formerly: ANTH705.
Individual instruction course supervised by a department faculty member.

ANTH 856 Museum Research Seminar (3 credits)

Prerequisite: HIST610. Also offered as: HIST810, AMST856. Credit only granted for: ANTH856, AMST856, or HIST810.
A research seminar focusing on the practice and presentation of cultural and historical scholarship in museums and historical sites. Students will complete an original research project on the challenges and opportunities of public exhibition and interpretation of cultural and historical research.

ANTH 857 Museum Scholarship Practicum (3-6 credits)

Prerequisite: HIST810. Restriction: Permission of Museum Scholarship Program required. Also offered as: HIST811, AMST857. Credit only granted for: ANTH857, AMST857, or HIST811.
Students devise and carry out a research program using the collections at the Smithsonian Institution or some other cooperating museum, working under joint supervision of a museum professional and a university faculty member.

ANTH 898 Pre-Candidacy Research (1-8 credits)

ANTH 899 Doctoral Dissertation Research (6 credits)

Atmospheric and Oceanic Science (AOSC)

AOSC 400 Physical Meteorology of the Atmosphere (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (PHYS171, PHYS161, MATH141); or permission of CMNS-Atmospheric & Oceanic Science department. Formerly: METO400.
The application of basic classical physics, chemistry and mathematics t the study of the atmosphere. Composition of the atmosphere; energy sources and sinks (radiation in the atmosphere; radiative balance and radiative forcing of atmospheric processes); atmospheric thermodynamics; clouds and precipitation physics; atmospheric electricity and optics; mesoscale processes (e.g., orographic mesoscale phenomena and instabilities); air mass boundaries; severe weather, tropical cyclones; storms; global circulation.

AOSC 401 Climate Dynamics and Earth System Science (3 credits)

Prerequisite: AOSC400 or AOSC200; or permission of instructor. Formerly: METO401.
The global weather and climate system; the natural variability of the atmosphere-ocean-biosphere; carbon cycle and biogeochemistry. Potential human effects: greenhouse effects, deforestation, acid rain, ozone depletion, nuclear winter. Social, political and economic effects of changes in global environment. Policy options.

AOSC 420 Physical Oceanography (3 credits)

Prerequisite: MATH141 and PHYS141. Recommended: AOSC200. Also offered as: AOSC670, GEOL670. Credit only granted for: AOSC420, AOSC670, or GEOL670.
Ocean observations. Water masses, sources of deep, intermediate, and surface water. Mass, heat, and salt transport, and the meridional overturning circulation. Geochemical tracers and cycles, including carbon. Western boundary currents, mixed layers, and processes maintaining the thermocline. Coastal and estuarine processes. Surface waves and tides. the ocean's role in climate.

AOSC 424 Remote Sensing of the Atmosphere and Ocean (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (PHYS171, PHYS161, MATH141); or permission of instructor.
Many of the properties of the atmosphere, ocean, and land surface are most easily observed from satellite remote sensing. This course will provide students with a hands-on introduction to a variety of passive and active sensing techniques and sensors observing our changing environment. Topics include: orbital dynamics and electromagnetic properties of the atmosphere and surface; atmospheric emission characteristics and scattering; chemical composition and spectroscopy; temperature retrievals; detection and retrieval of aerosol, cloud and rain; ocean surface properties; sea surface temperature and color; active sensing of wind stress, sea level, and internal waves; time-dependent gravity; properties of vegetation and ice.

AOSC 431 Atmospheric Thermodynamics (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (PHYS171, PHYS161, MATH141). Recommended: MATH246. Credit only granted for: AOSC431 or METO431. Formerly: METO431.

Classical thermodynamics applied to both the dry and the moist atmosphere. Composition; phase changes of water; stability concepts; Properties of aerosols and clouds, cloud nucleation and precipitation processes, atmospheric electricity, cloud and precipitation chemistry.

AOSC 432 Dynamics of the Atmosphere and Ocean (3 credits)

Prerequisite: AOSC431. Corequisite: MATH246. Credit only granted for: AOSC432, METO432, or AOSC632. Formerly: METO432.

Equations of motion and their approximation, scale analysis for the atmosphere and the ocean. Conservation properties. Fluid motion in the atmosphere and oceans. Geostrophic/balanced and ageostrphic/unbalanced motion. Circulation, vorticity, and potential vorticity. Introduction to the boundary layer.

AOSC 434 Air Pollution (3 credits)

Prerequisite: MATH241; or permission of CMNS-Atmospheric & Oceanic Science department. Formerly: METO434.

Production, transformation, transport and removal of air pollutants. The problems of photochemical smog, the greenhouse effect, stratospheric ozone, acid rain and visibility. Analytical techniques for gases and particles.

AOSC 436 Principles of Biogeochemistry (3 credits)

Prerequisite: MATH140 or MATH220; and (GEOL100 or GEOL120); and GEOL322. And CHEM131 and CHEM132; or (CHEM135 and CHEM136). Restriction: Non-degree-seeking students require the permission of the instructor. Also offered as: GEOL436. Credit only granted for: GEOL436 or AOSC436.

An introduction to the basic principles of biogeochemistry including aspects of organic geochemistry, biochemistry, microbiology, global geochemical cycles, the origin of life and paleoenvironmental evolution.

AOSC 437 Global Climate Change: Past and Present (3 credits)

Prerequisite: MATH115 or MATH140; and (GEOL100 or GEOL120); and (CHEM131 or CHEM135); and (CHEM132 or CHEM136). Restriction: Non-degree seeking students require permission of the instructor. Also offered as: GEOL437.

A highlight to the fact that global climate change is part of the Earth's past as well as of its present and future. Changes in climate that have occurred in the geologic past can be viewed as the Earth's natural climate variability. These changes are different from, though could be linked with, historical and present anthropogenically-induced climate change. We will discuss the modern climate system, the factors capable of forcing climate change on various time scales, the geologic proxies of past climate change and what these proxies tell us. Finally, we will compare and contrast past climate change with what is understood (and not understood) about modern climate change.

AOSC 458 Advanced Topics in Atmospheric and Oceanic Science (1-4 credits)

Repeatable to 12 credits.

Special topics in atmospheric and oceanic science are given intensive study. The topic of concentration varies, from semester to semester and depends on student and faculty interests. Often, specialists from other institutions are invited to the campus on a visiting lectureship basis to conduct the course.

AOSC 470 Synoptic Meteorology (3 credits)

Prerequisite: Minimum grade of C- in AOSC431 and AOSC432. Credit only granted for: AOSC470, AOSC600, or METO600.

Atmospheric properties and observations, meteorological analysis and charts, operational numerical forecasts. Application of quasigeostrophic theory, baroclinic instability, midlatitiude and mesoscale weather systems. Tropical meteorology. Weather forecasting using numerical and statistical models. Prediction of weather phenomena on the global, syoptic, meso, and local scales. Analysis of surface and upper air data; Norwegian cyclone model; introduction to weather forecasting.

AOSC 472 Mesoscale Meteorology (3 credits)

Prerequisite: AOSC432, AOSC600, AOSC610, or AOSC470. Restriction: Non-degree-seeking students require the permission of the instructor. Also offered as: AOSC602. Credit only granted for: AOSC472 or AOSC602.

An introduction to mesoscale meteorology including the topics of mesoscale approximations, aspects of fronts and frontogenesis theory, piecewise potential vorticity inversion, mesoscale waves and instability, orographic mesoscale phenomena, isolated convection, mesoscale convective systems, and tropical cyclones.

AOSC 493 Senior Research Project I (3 credits)

Prerequisite: Permission of CMNS-Atmospheric & Oceanic Science department. Restriction: Must be in Atmospheric and Oceanic Science program. Or must not be in Atmospheric and Oceanic Science program; and permission of instructor.

Technical writing and oral presentation skills. Planning, writing, and presenting a plan for research in the geosciences.

AOSC 494 Atmospheric and Oceanic Science Seminar (1 credits)

Prerequisite: Minimum grade of C- in AOSC431 and AOSC432.

Exposure to a wide range of contemporary topics in atmospheric, oceanic, and climate sciences, to foster research interests and promote critical thinking through the weekly AOSC departmental seminar series.

AOSC 498 Senior Research Project II (3 credits)

Prerequisite: AOSC493.

The project will be based on the research or development plan created in AOSC493. It may be completed with the approval of a faculty advisor in conjunction with an internship. Final written thesis and oral defense will be expected.

AOSC 499 Special Problems in Atmospheric Science (1-3 credits)

Prerequisite: Permission of CMNS-Atmospheric & Oceanic Science department. Repeatable to 6 credits. Formerly: METO499.

Research or special study in the field of meteorology and the atmospheric and oceanic sciences.

AOSC 600 Synoptic Meteorology I (3 credits)

Prerequisite: AOSC610. Credit only granted for: AOSC470 or AOSC600. Formerly: METO600.

Atmospheric properties and observations, meteorological analysis and charts, operational numerical forecasts. Application of quasigeostrophic theory, baroclinic instability, midlatitude and mesoscale weather systems. Tropical meteorology.

AOSC 602 Mesoscale Meteorology (3 credits)

Mesoscale approximations, cyclones and fronts, quasi- versus semi-geostrophic theory, piece-wise PV inversion, waves and instability, isolated convection, organized convective systems, numericalmodeling and convective parameterization.

AOSC 610 Dynamics of the Atmosphere and Ocean I (3 credits)

Prerequisite: Must have completed or be concurrently enrolled in MATH462; or students who have taken courses with comparable content may contact the department. Formerly: METO610.

Equations of motion and their approximation, scale analysis for the atmosphere and the ocean. Conservation properties. Fluid motion in the atmosphere

and oceans. Circulation and vorticity, geostrophic motion and the gradient wind balance. Turbulence and Ekman Layers.

AOSC 611 Dynamics of the Atmosphere and Oceans II (3 credits)

Formerly: METO611.

Waves and instabilities in the atmosphere and the ocean. Gravity, Rossby, coastal and equatorial waves. Flow over topography. Dynamic instabilities including barotropic, baroclinic, inertial, and instabilities of the coupled ocean-atmosphere system. Stationary waves and multiple equilibria.

AOSC 614 Atmospheric Modeling, Data Assimilation and Predictability (3 credits)

Prerequisite: AOSC610; or permission of instructor. Formerly: METO614.

Solid foundation for atmospheric and oceanic modeling and numerical weather prediction: numerical methods for partial differential equations, an introduction to physical parameterizations, modern data assimilation, and predictability.

AOSC 615 Advanced Methods in Data Assimilation for the Earth Sciences (3 credits)

Prerequisite: AOSC614; or permission of instructor.

An overview of the most important methods of data assimilation. Theory, techniques and strategies of these methods, as well as their possible drawbacks. Hands-on experimentation with variational and other data assimilation systems.

AOSC 617 Atmospheric and Oceanic Climate (3 credits)

Prerequisite: AOSC610; or permission of instructor. Formerly: METO617.

The general circulation of the atmosphere and oceans, historical perspective, observations, and conceptual models; wind-driven and thermohaline circulation of the oceans. Seasonal cycle and monsoon circulations; interannual to interdecadal climate variability; climate change.

AOSC 620 Physics and Chemistry of the Atmosphere I (3 credits)

Prerequisite: MATH461; or students who have taken courses with comparable content may contact the department. Formerly: METO620.

Air parcel thermodynamics and stability; constituent thermodynamics and chemical kinetics. Cloud and aerosol physics and precipitation processes.

AOSC 621 Physics and Chemistry of the Atmosphere II (3 credits)

Prerequisite: MATH462; or students who have taken courses with comparable content may contact the department. Formerly: METO621.

Spectroscopy; basic concepts in radiative transfer and atmospheric chemistry; photolysis rates for atmospheric molecules.

AOSC 624 Remote Sensing of Surface Climate (3 credits)

Prerequisite: MATH240 and MATH241.

The theory and principles of remote sensing as applicable to earth observing satellites. Discussed will be current methods to interpret satellite observations into useful climate parameters. Emphasis will be placed on parameters that provide information about the climate close to the earth surface, and that can be inferred on regional to global scales. Examples are: surface temperature and reflectivity, radiation budgets, soil moisture, and vegetation cover.

AOSC 625 Remote Inference of Atmospheric Properties by Satellite (3 credits)

Prerequisite: AOSC621. And MATH461; or students who have taken courses with comparable content may contact the department. Recommended: Non-degree-seeking students require permission of the instructor. Formerly: METO625.

Fundamentals of radiative transfer concepts, theories and models pertinent to remote sensing. Satellite platforms, sensors and systems used for operation and research in atmospheric remote sensing. Concepts and technologies of passive and active remote sensing. Remote sensing methods and products of atmospheric constituents, aerosol, cloud, precipitation, temperature and water vapor profiles, precipitation in liquid and ice forms, radiation budget, and remote sensing application in data assimilation for numerical weather forecast (NWP); use of atmospheric remote sensing products for development of global climate model (GCM).

AOSC 630 Statistical Methods in Meteorology and Oceanography (3 credits)

Prerequisite: STAT400; or students who have taken courses with comparable content may contact the department. Formerly: METO630.

Parametric and non-parametric tests; time series analysis and filtering; wavelets. Multiple regression and screening; neural networks. Empirical orthogonal functions and teleconnections. Statistical weather and climate prediction, including MOS, constructed analogs. Ensemble forecasting and verification.

AOSC 632 Atmsopheric Dynamics (3 credits)

Prerequisite: AOSC431. Corequisite: MATH246. Restriction: Must not have completed AOSC432. Credit only granted for: AOSC432 or AOSC632.

The equations of motion of the atmosphere are developed, and then analyzed with a focus on developing students' intuition about the behavior of the large-scale atmospheric flow in the mid-latitudes. Topics covered: Kinematics; forces in the atmosphere; apparent forces arising from the rotation of the earth; vertical coordinate systems; spherical coordinate; natural coordinates; hydrostatic, cyclostrophic; geostrophic and gradient wind balances; diagnosis of vertical motion (the omega equation); prediction of surface pressure; dynamics of fronts; lifecycle of baroclinic distrubances; introduction to climate sensitivity and climate feedbacks.

AOSC 633 Atmospheric Chemistry and Climate (3 credits)

Prerequisite: CHEM131, CHEM135, or CHEM146. And MATH241; or permission of CMNS-Atmospheric & Oceanic Science department. Also offered as: CHEM633. Credit only granted for: AOSC433, AOSC633, CHEM433, or CHEM633. Formerly: AOSC658R.

The effects of human activity on atmospheric composition, focused on global warming, the carbon cycle, air pollution, and the ozone layer. Fundamentals of atmosphereic chemistry (spectroscopy, kinetics, isotopic analysis, and biogeochemical cycles) are related to the modern understanding of climate change, air quality, and ozone depletion, based on resources such as satellite missions, field campaigns, and scientific assessments published by international agencies. We also examine how society's energy needs could be met, in the future, in a manner with less impact on atmospheric composition than the present heavy reliance on combusion of fossil fuels.

AOSC 634 Air Sampling and Analysis (3 credits)

Formerly: METO634.

Theory and application of analytical techniques for the analysis of atmospheric gases and particles including priority pollutants. Combined chemical and meteorological considerations in designing field experiments.

AOSC 637 Atmospheric Chemistry (3 credits)

Prerequisite: CHEM481. Formerly: METO637.

Application of the techniques of thermodynamics, kinetics, spectroscopy and photochemistry to atmospheric gases and particles. Investigation of the global cycles of C, H, O, N, and S species; the use of laboratory and field measurements in computer models of the atmosphere.

AOSC 652 Analysis Methods in Atmospheric and Oceanic Science (3 credits)

Prerequisite: PHYS141 and MATH241; or students who have taken courses with comparable content may contact the department. Recommended: AMSC460, CMSC660, AMSC660, or CMSC460.

A variety of the analysis methods used by atmospheric and oceanic scientists will be applied to observational data sets such as Vostok ice core record, temperature trends, and satellite measurements of ozone,sea ice, etc. in a hands-on, computer laboratory setting. Students will be exposed to Fortran, IDL, and Matlab as well as modern file formats such as HDF and netCDF. No prior programming experience required.

AOSC 658 Special Topics in Meteorology (1-3 credits)

Restriction: Permission of instructor. Formerly: METO658.

Various special topics in meteorology are given intensive study. The topic of concentration varies, from semester to semester and depends on student and faculty interests. Often, specialists from other institutions are invited to the campus on a visiting lectureship basis to conduct the course.

AOSC 661 Sustainability Modeling (3 credits)

Suitable for students who are concerned with sustainability issues, have little or no background in computational modeling, but would like to understand what modeling can do to help solve sustainability problems. By exploring a variety of contemporary societal issues (e.g., water scarcity, biodiversity loss, energy dependence), you will be introduced to modeling approaches for simulating and quantitatively understanding sustainability variables (inputs and outputs), and using modeling towards the design of policy measures that can be implemented as a response to such issues.

AOSC 662 Ecohydrology (3 credits)

Prerequisite: AOSC610; and undergraduate level hydrology and/or hydrogeology, familiarity with differential calculus and equations. Please consult with instructor for details.

The vulnerability and resilience of ecosystems are dependent on phenomena that link the cycling of water, nutrients and other biogeochemically active elements. Understanding the perturbations in these cycles that trigger impacts on ecosystem spatiotemporal characteristics is a challenge that generally transcends disciplinary and geographical boundaries, and is key to sustaining the diversity of life on Earth. This course on ecohydrology focuses on the study of hydrologically-controlled ecosystems, e.g. systems in which either excess and/or deficit of water and nutrients are determinants of its structure and function. Such systems have complex dynamic characteristics that depend on many interrelated links between climate, soil and vegetation.

AOSC 663 Water and Climate Systems (3 credits)

Prerequisite: AOSC610; and undergraduate level hydrology and/or hydrogeology, familiarity with differential calculus and equations. Please consult with instructor for details.

Focuses on exploring options for adaptation and building resilience to the possible impacts of climate change through an interwoven understanding of the physical, biological, social, cultural, economic and institutional constraints of water resources issues and consideration of climate-related risks in the management and decision-making process.

AOSC 670 Physical Oceanography (3 credits)

Prerequisite: Permission of CMNS-Atmospheric & Oceanic Science department. Also offered as: AOSC420, GEOL670. Credit only granted for: GEOL670, AOSC670 or AOSC420.

Ocean observations. Water masses, sources of deep water. Mass, heat, and salt transport, geochemical tracers. Western boundary currents, maintenance of the thermocline. Coastal and estuarine processes. Surface waves and tides. Ocean climate.

AOSC 675 Carbon Cycle and Climate: Past, Present, and Future (3 credits)

The fundamentals of the Earth's carbon cycle, a key biogeochemical cycle that controls Earth's climate and life. The changing characteristics of the carbon cycle on several timescales, ranging from geological, interannual, and the more recent anthropogenic influences on carbon cycle and climate. The carbon cycle in the atmosphere, land, ocean, and the biosphere. The underlying human activities such as fossil fuel burning and deforestation that are responsible for the increase in the atmosphere CO2 and our future options in dealing with the carbon problem such as alternative energy and carbon sequestration.

AOSC 680 Introduction to Earth System Science (3 credits)

An introduction to the study of the earth as a system: atmosphere, oceans, land, cryosphere, solid earth, and humans. Cycling of materials and energy in the earth system: the energy cycle, the hydrologic cycle, the carbon cycle, the nitrogen cycle. Climate processes and variability: land-atmosphere, ocean-atmosphere, biosphere-climate, and human interactions, short- and long-term variability in climate.

AOSC 684 Climate System Modeling (3 credits)

Fundamentals in building computer models to simulate the components of the climate system: atmosphere, ocean ice, land-surface, terrestrial and marine ecosystems, and the biogeochemical cycles embedded in the physical climate system, in particular, the carbon cycle. Simple to state-of-the-art research models to tackle problems such as the Daisy World, El Nino and global warming.

AOSC 798 Directed Graduate Research (1-3 credits)

Formerly: METO798.

AOSC 818 Frontiers in Atmosphere, Ocean, Climate, and Synoptic Meteorology Research (1 credits)

Repeatable to 18 credits if content differs.

A broad range of topics in the contemporary sciences of atmosphere, ocean, climate and synoptic meteorology are covered.

AOSC 898 Pre-Candidacy Research (1-8 credits)

AOSC 899 Doctoral Dissertation Research (1-8 credits)

Arabic (ARAB)

ARAB 401 Readings in Arabic Literature (3 credits)

Prerequisite: ARAB305; or permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Must not be a fluent/native speaker of Arabic.

A survey of Modern Arabic literature is given through a range of selected texts. Texts are studied as literature with constant reference to the social, cultural and political contexts in which they were written. Taught in Arabic.

ARAB 402 Arabic English Translation (3 credits)

Prerequisite: ARAB305; or permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Must not be a fluent/native speaker of Arabic.

In-depth practicum in translation from Arabic to English. Exploration of the complexities of translation as an exercise of textual interpretation and linguistic transformation.

ARAB 412 Modern Arabic Literature: A Survey (3 credits)
Prerequisite: ARAB305; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Themes and genres of Arabic literature from the mid-19th century to the present. Focus on content and acquisition of Modern Standard Arabic. Taught in Arabic.

ARAB 489 Special Topics in Arabic Studies (3 credits)
Prerequisite: ARAB305; or permission of ARHU-School of Languages, Literatures, and Cultures department.
In-depth study of particular aspect of Arabic language and culture. Specific topics to be announced when course is offered. Taught in Arabic.

ARAB 499 Special Topics in Arabic Studies (3 credits)
Repeatable to 6 credits if content differs.
In-depth study of particular aspect of Arabic culture, literature and language. Specific topic to be announced when course is offered.

ARAB 603 Advanced Arabic into English Translation (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Practicum in translation from Arabic into English. Study of interdependence of language, context, and culture.

ARAB 604 Arabic to English Interpreting (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Practicum in interpreting from Arabic into English. On-sight, consecutive, and simultaneous.

ARAB 610 Islamic Culture (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
In-depth study of core topics related to Islamic culture and society, e.g. the political system, caliphates, reform movements, Shari's law. Taught in Arabic.

ARAB 628 Special Topics in Arabic Studies (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
In-depth study of a particular aspect of Arabic Studies. Topics to be announced when course if offered. Taught in Arabic.

ARAB 638 Special Topics in Middle Eastern Studies (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
In-depth study of a particular aspect of Middle Eastern Studies. Topic to be announced when course is offered. Taught in Arabic.

ARAB 640 Socio-political Issues in Contemporary Arab Societies (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
In-depth study of major social and political issues in Arab world today. Inter-Arab dynamics, economic impact of globalization, pressure for westernization in areas such as democratic state institutions, women's rights, human rights, role of religion in government and the law. Taught in Arabic.

ARAB 650 The Arab World and Contemporary International Relations (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Examines the political interests and diplomatic positions of Arabic-speaking countries in the contemporary international context. Taught in Arabic.

ARAB 788 Internship in Arabic (3-6 credits)
Restriction: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Field and/or professional experience in a public or private institution where Arabic is the language of work.

ARAB 789 Independent Study in Arabic (1-3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 9 credits if content differs.
Independent study in Arabic. Taught in Arabic.

Architecture (ARCH)

ARCH 400 Architecture Design Studio I (6 credits)
Restriction: Must be in a major in ARCH-Architecture Program; and permission of ARCH-Architecture Program.
Introduction to architectural design with particular emphasis on conventions and principles of architecture, visual and verbal communication skills, formal analysis, design process, spatial composition, architectural promenade, basic program distribution, and elementary constructional and environmental responses.

ARCH 401 Architecture Design Studio II (6 credits)
Prerequisite: Minimum grade of C- in ARCH400. Restriction: Must be in Architecture (B.S.) program.
Continuation of ARCH 400 with introduction to building typology, urban and contextual issues, design of the vertical surface, and architectural interiors.

ARCH 402 Architecture Design Studio III (6 credits)
Prerequisite: Minimum grade of C- in ARCH401. Restriction: Must be in Architecture (B.S.) program.
Architectural design studio with emphasis on building and facade typologies, the development of architectural promenade and sequence, public and/or civic infill buildings dependent upon the architectural promenade, and urban housing types of varying densities. The architect's obligations to urban context are explored in many dimensions including historical, typological, and physical.

ARCH 403 Architecture Design Studio IV (6 credits)
Prerequisite: Minimum grade of C- in ARCH402. Restriction: Must be in Architecture (B.S.) program.
Investigations into the relationship between the man-made and the natural world including introductory issues of assembly and material value. Design of the site and the building are combined into an integral process delimiting and probing the boundaries of each and exploring their reciprocal relationship. The architect's obligations to the natural and urban contexts are explored in many dimensions including historical, typological, environmental, and physical.

ARCH 404 Graduate Architecture Design Studio I (6 credits)
Recommended: For 3 1/2 year graduate students only. Restriction: Must be in Architecture (Master's) program.
Introduction to architectural design with particular emphasis on conventions and principles of architecture , visual and verbal communication skills, formal analysis, design process, spatial composition, architectural promenade, basic program distribution, and elementary constructional and environmental responses. Offered fall only.

ARCH 405 Graduate Architecture Design Studio II (6 credits)
Prerequisite: Minimum grade of C- in

ARCH404. Restriction: Must be in Architecture (Master's) program.
Architectural design studio with emphasis on building and facade typologies, the development of architectural promenade and sequence, public and/or civic infill buildings dependent upon the architectural promenade, and urban housing types of varying densities. The architect's obligations to urban context are explored in many dimensions including historical, typological, and physical. Offered spring only.

ARCH 406 Graduate Architecture Design Studio III (6 credits)

Prerequisite: Minimum grade of C- in ARCH405. Restriction: Must be in Architecture (Master's) program.
Investigations into the relationship between the man-made and the natural world including introductory issues of assembly and material value. Design of the site and the building are combined into an integral process delimiting and probing the boundaries of each and exploring their reciprocal relationship. The architect's obligations to the natural and urban contexts are explored in many dimensions including historical, typological, environmental, and physical.

ARCH 407 Graduate Architecture Design IV (6 credits)

Prerequisite: Minimum grade of C- in ARCH406. Restriction: Must be in Architecture (Master's) program.
Studio problems and theories concentrating on urbanism and urban design techniques. Issues and sites range from high-density urban in-fill to suburban and greenfield development in American and other contexts. Studio theories explore such topics as Contextualism, Neo-Traditional design, Transit Oriented Development, density, sustainable development, building typology, and street design.

ARCH 408 Special Topics Architecture Design Studio (6 credits)

Restriction: Must be in a major in ARCH-Architecture Program; and permission of ARCH-Architecture Program. Repeatable to 12 credits if content differs. Additional information: Elective Architecture Design Studio that may be taken for repeat or advanced credit for arch400 arch401 arch402 arch403 and/or an additional design studio.
Design Studio course to examine topical problems in architecture and urban design.

ARCH 410 Architecture Technology I (4 credits)

Prerequisite: MATH220 or MATH140; and PHYS121; and (GEOG140, GEOG123, GEOL120, AOSC123, GEOL123, or BSCI205). Corequisite: ARCH400. Restriction: Must be in Architecture (B.S.) program.
First course in a four course sequence which develops the knowledge and skills of architectural technology. Addresses climate, human responses to climate, available materials, topography and impact on culture. Principles of assembly, basic structural principles and philosophies of construction.

ARCH 411 Technology II (4 credits)

Prerequisite: ARCH410. Corequisite: ARCH401. Restriction: Must be in Architecture (B.S.) program.
Second course in a four course sequence. Building construction processes and terminology; use and performance characteristics of primary building materials; principles of structural behavior related to the building systems; equilibrium and stability, stiffness and strength, types of stress, distribution of force and stress, resolution of forces, reactions, bending moments, shear, deflection, buckling.

ARCH 412 Architecture Technology III (4 credits)

Prerequisite: Minimum grade of C- in ARCH411. Corequisite: ARCH402. Restriction: Must be in Architecture (B.S.) program.
Third course in a four course sequence. Design of steel, timber, and reinforced concrete elements and subsystems; analysis of architectural building systems. Introduction to design for both natural and man-made hazards.

ARCH 413 Architecture Technology IV (4 credits)

Prerequisite: ARCH412. Corequisite: ARCH403. Restriction: Must be in Architecture (B.S.) program.
Final course in a four course sequence. Theory, quantification, and architectural design applications for HVAC, water systems, fire protection electrical systems, illumination, signal equipment, and transportation systems.

ARCH 418 Selected Topics in Architectural Technology (3 credits)

Restriction: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Selected Topics in Architectural Technology

ARCH 419 Independent Studies in Architectural Technology (1-4 credits)

Restriction: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Proposed work must have a faculty sponsor and receive approval of the Architecture Program Curriculum Committee.

ARCH 420 History of American Architecture (3 credits)

Prerequisite: ARCH221; or permission of ARCH-Architecture Program.
American architecture from the late 17th to the 21st century.

ARCH 422 History of Greek Architecture (3 credits)

Prerequisite: ARCH221; or permission of ARCH-Architecture Program.
Survey of Greek architecture from 750-100 B.C.

ARCH 423 History of Roman Architecture (3 credits)

Prerequisite: Permission of ARCH-Architecture Program.
Survey of Roman architecture from 500 B.C. To A.D. 325.

ARCH 426 Fundamentals of Architecture (3 credits)

Restriction: Must be in Architecture (B.S.) program; and must be in the 3.5 year M. ARCH program.
Thematic introduction of a variety of skills, issues, and ways of thinking that bear directly on the design and understanding of the built world.

ARCH 427 Theories of Architecture (3 credits)

Prerequisite: ARCH426; or permission of ARCH-Architecture Program. Restriction: Must be in Architecture (B.S.) program.
Selected historical and modern theories of architectural design.

ARCH 428 Selected Topics in Architectural History (1-3 credits)

Prerequisite: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Special topics in the history of architecture.

ARCH 429 Independent Studies in Architectural History (1-4 credits)

Repeatable to 6 credits.
Proposed work must have faculty sponsor and receive approval of the Curriculum Committee.

ARCH 430 Measuring Sustainability in Architecture (3 credits)

Credit only granted for: ARCH430 or ARCH418M. Formerly: ARCH418M.
Studies metrics of sustainability as included in rating standards, including

LEED. All students will take the LEED GA test.

ARCH 433 History of Renaissance Architecture (3 credits)
Prerequisite: ARCH221; or permission of ARCH-Architecture Program.
Renaissance architectural principles and trends in the 15th and 16th centuries and their modifications in the Baroque period.

ARCH 434 History of Modern Architecture (3 credits)
Prerequisite: ARCH221; or permission of ARCH-Architecture Program.
Architectural trends and principles from 1750 to the present, with emphasis on developments since the mid-19th century.

ARCH 435 History of Contemporary Architecture (3 credits)
Prerequisite: ARCH221; or permission of ARCH-Architecture Program.
Architectural history from World War II to the present.

ARCH 442 Studies in the Vertical Surface (3 credits)
Prerequisite: ARCH221; or permission of ARCH-Architecture Program.
Theories of analysis and design related to vertical surface. Exercises include documentation, analysis, and design of facades.

ARCH 443 Visual Communication For Architects (3 credits)
Corequisite: ARCH400. Restriction: Must be in Architecture (Master's) program; and must be in the 3.5 year M. ARCH program.
Investigation of the relationship between drawing from life and architectural drawing, the conventions of architectural drawing and the role of architectural drawing as a means to develop, communicate, and generate architectural ideas.

ARCH 445 Visual Analysis of Architecture (3 credits)
Prerequisite: ARCH400; or permission of ARCH-Architecture Program. Restriction: Must be in Architecture (B.S.) program.
Study of visual principles of architectural and urban precedents through graphic analysis. Exercises include on-site observation, documentation and analysis. Focuses on the development of an architect's sketchbook as a tool for life-long learning.

ARCH 448 Selected Topics in Visual Studies in Architecture (3 credits)
Restriction: Permission of ARCH-Architecture Program; and must be in a major in ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Selected Topics in Visual Studies in Architecture

ARCH 449 Independent Studies in Visual Studies in Architecture (1-4 credits)
Restriction: Permission of ARCH-Architecture Program; and must be in a major in ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Proposed work must have a faculty sponsor and receive approval of the Architecture Program Curriculum Committee.

ARCH 456 Great Cities (3 credits)
Prerequisite: Permission of ARCH-Architecture Program.
Case studies from a selection of the great cities of the world.

ARCH 458 Selected Topics in Urban Design (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program; and permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Selected Topics in Urban Design

ARCH 459 Independent Studies in Urban Design (1-4 credits)
Restriction: Must be in a major in ARCH-Architecture Program; and permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Proposed work must have a faculty sponsor and receive approval of the Architecture Program Curriculum Committee.

ARCH 460 Site Analysis and Design (3 credits)
Prerequisite: ARCH400; or permission of ARCH-Architecture Program.
Principles and methods of site analysis; the influence of natural and man-made site factors on site design and architectural form.

ARCH 461 Sustainability in Architecture (3 credits)
Prerequisite: ARCH401; and ARCH410. Or permission of ARCH-School of Architecture, Planning, & Preservation. Credit only granted for: ARCH418S or ARCH461. Formerly: ARCH418S.
Strategies of sustainability as related to the broader context of architectural problem solving.

ARCH 462 Methods & Materials of Building Construction (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program; or must be in Construction Project Management Minor. Credit only granted for: ARCH410 or ARCH462.
Building Construction methods and materials are examined through case studies to explore the means and techniques applied to the material execution of buildings and BIM. Focus on an understanding of the organization of the design and construction process and awareness of building and zoning codes, material systems and types.

ARCH 463 Sustainable Systems in Architecture (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program.
Sustainable systems in architecture examines the nature of the global problem, environmental economics, understanding the local environment, bioclimatic design, solar control and shading, solar access zoning, residential scale energy design issues, commercial scale energy design issues, and urban scale energy design issues.

ARCH 464 Architectural Structures I (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program. Credit only granted for: ARCH411 or ARCH464.
This course covers the basic principles of architectural structures, including the influence of geometric, sectional, and material properties related to flexure and shear in beam and framed systems; vector mechanics with application to analysis of trusses, catenaries, and arches; diagrammatic analysis of beams for bending moment, shear, and deflection as well as the study of structural framing systems for vertical and lateral loads.

ARCH 465 Architectural Structures II (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program. Credit only granted for: ARCH412 or ARCH465.
The basic principles of elastic behavior for different materials such as wood, steel, concrete, and composite materials and compares the properties and applications of materials generally will be covered. It investigates cross sectional stress and strain behavior in flexure and in shear, and torsion as well as the stability of beams and columns. The qualitative behavior of combined stresses and fracture in materials is also covered.

ARCH 466 Environmental Systems in Architecture (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program. Credit

only granted for: ARCH413 or ARCH466.
Environmental systems in architecture presents the theory, quantification, and architectural design implications for heating ventilating and air conditioning, water and waste, fire protection, electricity, illumination, acoustics, and vertical transportation.

ARCH 467 Integrated Project Delivery (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program; or must be in Construction Project Management Minor.
Integrated Project Delivery is examined from design to implementation through an exploration of building construction, architectural design and construction management perspectives.

ARCH 470 Computer Applications in Architecture (3 credits)
Prerequisite: ARCH400; or permission of ARCH-Architecture Program. Restriction: Must be in Architecture (B.S.) program.
Introduction to computer utilization, with emphasis on architectural applications.

ARCH 472 Building Information Modeling Communication and Collaboration (3 credits)
Restriction: Must be in a major in ARCH-Architecture Program; or must be in the Construction Project Management Minor. Credit only granted for: ARCH678I or ARCH472. Formerly: ARCH678I.
Building Information Modeling is explored as pertains to collaboration and communication in the design and construction of buildings and building systems. Practical and empirical learning using BIM software and case studies of real world projects and construction scenarios.

ARCH 474 Integrated Education in Architecture NAAB/IDP (1 credits)
Restriction: Must be in a major in ARCH-Architecture Program.
Examine National Architectural Accrediting Board (NAAB) student performance criteria in the context of architectural education. Contextualize NAAB accredited curricula and examine the relationship to graduate study and professional practice, including the Intern Development Program (IDP) of the National Council of Architectural Registration Boards (NCARB).

ARCH 478 Selected Topics in Architecture (1-4 credits)
Prerequisite: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.

ARCH 479 Independent Studies in Architecture (1-4 credits)
Repeatable to 6 credits.
Proposed work must have a faculty sponsor and receive approval of the Curriculum Committee.

ARCH 481 The Architect in Archaeology (3 credits)
Prerequisite: Permission of ARCH-Architecture Program.
The role of the architect in field archaeology and the analysis of excavating, recording, and publishing selected archaeological expeditions.

ARCH 482 The Archaeology of Roman and Byzantine Palestine (3 credits)
Archaeological sites in Palestine (Israel and Jordan) from the reign of Herod the Great to the Moslem conquest.

ARCH 483 Field Archaeology (3 credits)
Prerequisite: Permission of ARCH-Architecture Program.
Participation in field archaeology with an excavation officially recognized by proper authorities of local government.

ARCH 488 Selected Topics in Architectural Preservation (1-3 credits)
Prerequisite: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.

ARCH 489 Independent Studies in Architectural Preservation (1-4 credits)
Repeatable to 6 credits.
Proposed work must have a faculty sponsor and receive approval of the Curriculum Committee.

ARCH 600 Comprehensive Design Studio V (6 credits)
Prerequisite: ARCH403; or students who have taken courses with comparable content may contact the department. Corequisite: ARCH611. Restriction: Must be in Architecture (Master's) program.
Comprehensive building and site design. Course content bridges the gap between design and technology, between practice and education, in a studio setting. Explorations include the integration of conceptual and technical aspects of architectural form and assembly, highlighting the ways in which multiple layers of a building design are developed, coordinated and resolved.

ARCH 601 Topical Studio (6 credits)
Prerequisite: ARCH600. Restriction: Must be in Architecture (Master's) program.
Topical architectural design studio with concentration on advanced theoretical, programmatic, contextual, and/or technical issues, with topical inquiry addressing but not limited to: architectural competitions, housing, sustainable design, collegiate architecture, regional architecture, classicism versus modernity.

ARCH 611 Advanced Architecture Technology Seminar (3 credits)
Prerequisite: ARCH413. Corequisite: ARCH600. Restriction: Must be in Architecture (Master's) program.
Technology in design of buildings. Application of technological issues in building design; integration of technology in architecture; technology as a form determinant in architecture; other conceptual and philosophical issues related to the application of technology in the design, construction, and use of buildings.

ARCH 628 Selected Topics in Architectural History (1-3 credits)
Prerequisite: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.
Special topics in the history of architecture.

ARCH 629 Independent Studies in Architectural History (1-4 credits)
Repeatable to 6 credits if content differs.
Proposed work must have faculty sponsor and receive approval of the Curriculum Committee.

ARCH 635 Seminar in the History of Modern Architecture (3 credits)
Prerequisite: ARCH427; or permission of ARCH-Architecture Program.
Advanced investigation of historical problems in modern architecture.

ARCH 654 Urban Development and Design Theory (3 credits)
Prerequisite: ARCH401; or permission of ARCH-Architecture Program.
Advanced investigation into the history, and practice of urban design, planning, and development.

ARCH 655 Urban Design Seminar (3 credits)
Prerequisite: ARCH654; or permission of ARCH-Architecture Program. Credit only granted for: ARCH451 or ARCH655. Formerly: ARCH451.
Advanced investigation into problems of analysis and evaluation of the design of urban areas, spaces, and complexes with emphasis on physical and social

considerations; effects of public policies through case studies. Field observations.

ARCH 670 Advance Comprehensive Computer Technology in Architecture (3 credits)
Prerequisite: ARCH403; and ARCH470. Or students who have taken courses with comparable content may contact the department. Credit only granted for: ARCH678C or ARCH670. Formerly: ARCH678C.
Comprehensive use of computer technology in the design process. Use of digital versus analog modeling to study design alternatives. Methods of representation to best convey concepts and integration of technology.

ARCH 673 Building Culture (3 credits)
Prerequisite: ARCH402; or permission of ARCH-Architecture Program. Restriction: Must be in Architecture (Master's) program.
Comprehension of major themes in the development of architectural building techniques and culture value systems in architecture are developed through lecture, discussion and analysis of seminal readings and buildings.

ARCH 674 Seminar in Regionalism (3 credits)
Prerequisite: ARCH600; or permission of ARCH-Architecture Program.
Regional characterisitics of culture, climate, and landscape as determinants world architecture.

ARCH 678 Selected Topics in Architecture (1-3 credits)
Prerequisite: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.

ARCH 679 Independent Studies in Architecture (1-4 credits)
Restriction: Must have faculty sponsor and proposed work must be approved by the Curriculum Committee. Repeatable to 4 credits if content differs.

ARCH 700 Advanced Urban Design Studio VII (6 credits)
Prerequisite: ARCH600; or permission of ARCH-Architecture Program.
Studio problems and theories concentrating on urbanism and urban design techniques. Issues and sites range from high density urban in-fill to suburban and greenfield development in American and other contexts. Studio theories explore such topics as Contextualism, Neo-Traditional design, Transit-Oriented Development, density, sustainable development building typology, and street design.

ARCH 770 Professional Practice (3 credits)
Prerequisite: ARCH601; or permission of ARCH-Architecture Program. Restriction: Must be in Architecture (Master's) program.
Project management, organizational, legal, economic and ethical aspects of architecture.

ARCH 778 Selected Topics in Urban Planning (1-3 credits)
Prerequisite: Permission of ARCH-Architecture Program. Repeatable to 6 credits if content differs.

ARCH 797 Thesis Proseminar (3 credits)
Prerequisite: ARCH601.
Directed research and preparation of thesis program.

ARCH 798 Thesis in Architecture (3 credits)
Prerequisite: ARCH797. Corequisite: ARCH799. Restriction: Must be in Architecture (Master's) program; and permission of ARCH-Architecture Program; and minimum cumulative GPA of 3.0.
Complements the research of ARCH 799, with presentation of the design research to student's thesis committee.

ARCH 799 Master's Thesis Research (1-6 credits)
Prerequisite: ARCH797. Corequisite: ARCH798. Restriction: Must be in Architecture (Master's) program; and permission of ARCH-Architecture Program; and minimum cumulative GPA of 3.0. Repeatable to 6 credits if content differs.
Development of master's thesis.

Agricultural and Resource Economics (AREC)

AREC 404 Applied Price Analysis (3 credits)
Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department. Restriction: Must be in one of the following programs (Agricultural and Resource Economics; Environmental Science & Policy-Env Economics; Agricultural and Resource Economics: Agribusiness) ; or must be minors in Agribusiness Economics (#AG01), Environmental Economics and Policy (#AG02), or Resource and Agricultural Policy in Economic Development (#AG03).
An introduction to the economic analysis of price behavior, with applications to agricultural commodities. The use of price information in the decision-making process, the relation and supply and demand in determining price, and the relation of prices to grade, time, location, and stages of processing in the marketing system.

AREC 405 Economics of Production (3 credits)
Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department. Restriction: Must be in one of the following programs (Agricultural and Resource Economics; Environmental Science & Policy-Env Economics; Agricultural and Resource Economics: Agribusiness) ; or must be minors in Agribusiness Economics (#AG01), Environmental Economics and Policy (#AG02), or Resource and Agricultural Policy in Economic Development (#AG03).
The use and application of production economics in analysis of firm and policy decisions. Production functions, cost functions, multiple product and joint production, and production processes through time.

AREC 422 Econometric Applications in Agricultural and Natural Resource Economics (3 credits)
Prerequisite: ECON326; or AREC326; or ECON306. Restriction: Must be in a major within the AGNR-Agricultural & Resource Economics department. Credit only granted for: ECON422, AREC422, or AREC489F. Formerly: AREC489F.
The main goal of this course is to equip students with valuable skills in econometricsand data analysis. Specifically, the main goal of the course is to teach you the basics ofthe theory and practice of econometrics, and to give you experience in estimatingeconometric models with actual data.

AREC 425 Economics of Food Sector (3 credits)
Corequisite: ECON306 or ECON326; or students who have taken courses with comparable content may contact the department. Credit only granted for: AREC425 or AREC489B. Formerly: AREC489B.
Economic analysis of food sector issues, including food safety, agricultural biotechnology, and coordination mechanisms in the food supply chain.

AREC 427 Economics of Commodity Marketing Systems (3 credits)
Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department. Restriction: Must be in one of the following programs

(Agricultural and Resource Economics; Environmental Science & Policy-Env Economics; Agricultural and Resource Economics: Agribusiness) ; or must be minors in Agribusiness Economics (#AG01), Environmental Economics and Policy (#AG02), or Resource and Agricultural Policy in Economic Development (#AG03).
Basic economic theory as applied to the marketing of agricultural commodities. Current developments affecting market structure including contractual arrangements, cooperative marketing, vertical integration, and governmental policies.

AREC 430 Introduction to Agricultural and Resource Law (3 credits)

Prerequisite: ECON326, ECON306, or AREC326. Restriction: Must be in a major within the AGNR-Agricultural & Resource Economics department. Credit only granted for: AREC430 or AREC489K. Formerly: AREC489K.
Survey of law with emphasis on problems and applications related to agricultural and natural resource economics. The course emphasizes strategies for managing legal risk arising from ownership, management, and use of agricultural resources. Students will get practical information to utilize in personal or professional settings. Contract law, constitutional law, tort law, property law, real estate transactions, business organization, estate planning, and debtor.

AREC 433 Food and Agricultural Policy (3 credits)

Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department.
Economic and political context of governmental involvement in the farm and food sector. Historical programs and current policy issues. Analysis of economic effects of agricultural programs, their benefits and costs, and comparison of policy alternatives. Analyzes the interrelationship among international development, agricultural trade and general economic and domestic agricultural policies.

AREC 435 Commodity Futures and Options (3 credits)

Prerequisite: (BMGT230; or ECON321); and (ECON306; or ECON326). Or students who have taken courses with comparable content may contact the department. Restriction: Must be in one of the following programs (Agricultural and Resource Economics; Environmental Science & Policy-Env Economics; Agricultural and Resource Economics: Agribusiness) ; or must be minors in Agribusiness Economics (#AG01), Environmental Economics and Policy (#AG02), or Resource and Agricultural Polcy in Economic Development (#AG03).
The economics and institutional features of commodity futures and options markets. Students will develop a basic understanding of the underlying price relationships between cash and futures markets and will apply this information to business risk management decision making.

AREC 445 Agricultural Development, Population Growth and the Environment (3 credits)

Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department.
Development theories, the role of agriculture in economic development, the agricultural policy environment, policies impacting on rural income and equity, environmental impacts of agricultural development.

AREC 446 Sustainable Economic Development (3 credits)

Credit only granted for: AREC446 or AREC489G. Formerly: AREC489G.
Examine why socially equitable and environmentally sustainable economic growth is difficult to achieve. It explores the interactive dynamics of environmental degradation, human capital, inequality and institutions. Emphasis is on the role of market imperfections and political failure in explaining the persistence of extractive economic institutions that hinder sustainable development.

AREC 453 Natural Resources and Public Policy (3 credits)

Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department.
Rational use and reuse of natural resources. Theory, methodology, and policies concerned with the allocation of natural resources among alternative uses. Optimum state of conservation, market failure, safe minimum standard, and cost-benefit analysis.

AREC 454 The Economics of Climate Change (3 credits)

Prerequisite: ECON326 or ECON306. Restriction: Must be in one of the following programs (Agricultural and Resource Economics; Environmental Science & Policy-Env Economics; Agricultural and Resource Economics: Agribusiness) ; or must be minors in Agribusiness Economics (#AG01), Environmental Economics and Policy (#AG02), or Resource and Agricultural Policy in Economic Development (#AG03). Credit only granted for: AREC454 or AREC489C. Formerly: AREC489C.
The role of economics in the formation of climate policy; basic concepts of environmental economics including efficiency, externalities, and policy instruments; economic models of intertemporal decisions and decision making in the face of uncertainty. Applied economic analysis of specific issues and current policy initiatives.

AREC 455 Economics of Land Use (3 credits)

Prerequisite: ECON326 or ECON306; or students who have taken courses with comparable content may contact the department.
Fundamentals of location theory. Microeconomics of land use decisions, including determination of rent and hedonic pricing models. Impacts of government decisions on land use, including regulation (e.g., zoning), incentives (transferable development rights), provision of public services, and infrastructure investments. Impacts of land use on environmental quality, including issues relating to sprawl, agricultural land preservation, and other topics of special interest.

AREC 456 Energy and Environmental Economics (3 credits)

Prerequisite: ECON326 or ECON306. Restriction: Must be in a major within the AGNR-Agricultural & Resource Economics department. Credit only granted for: AREC456 or AREC489J. Formerly: AREC489J.
Economic theory and empirical methods are used to study problems of energy, the environment, and the economy. It examines the extraction, production, and use of energy and market institutions and regulatory approaches used to correct market failures. Topics covered include: oil and natural gas markets, management and design of electricity markets, renewable energy, non-market valuation , climate change, and transportation policies.

AREC 489 Special Topics in Agricultural and Resources Economics (3 credits)

Repeatable to 9 credits.

AREC 610 Microeconomic Applications in Agricultural and Resource Markets (3 credits)

Prerequisite: ECON603.
Applications of graduate level microeconomic analysis to the problems of agricultural and natural resource production and distribution including demand for agricultural output, the nature of agricultural supply decisions, decision making under uncertainty, valuation of natural resources, and exploitation of natural resources.

AREC 620 Optimization in Agricultural and Resource Economics (3 credits)
Prerequisite: Must have completed Multivariate calculus and matrix or linear algebra.
Mathematical theory of static and dynamic optimization as applied to the economics of agriculture, natural resources and the environment. Topics include necessary and sufficient conditions for constrained optimization, convexity and concavity, duality and the envelope theorem, comparative statics, fixed point theorems, optimal control theory and dynamic programming.

AREC 623 Applied Econometrics I (4 credits)
Prerequisite: Differential and integral calculus and linear algebra; or permission of instructor.
Fundamentals of mathematical statistics for applications in econometrics. Development of the standard linear model and variations of assumptions with computer applications to applied econometric problems.

AREC 624 Applied Econometrics II (4 credits)
Prerequisite: AREC623.
Variations of the standard linear model, simultaneous equations estimation, nonlinear regression, nonlinear simultaneous equations estimation, static and dynamic panel data models, errors in variables, Hausman tests, discrete choice models such as conditional multinomial and mixed logit models, latent class models, semi-parametric estimation, varying parameter models, unobserved variables, time series models, and model selection procedures.

AREC 625 Economic Welfare Analysis (3 credits)
Also offered as: AREC825. Credit only granted for: AREC625 or AREC825.
The measurement of economic well-being for producers, consumers, and resource owners. Topics include competitive equilibrium, Pareto optimality, market failure, public goods and nonmarket welfare measurement, multimarket considerations, existing distortions, and second best. Applications in economic welfare analysis of agricultural and resource policies are discussed.

AREC 632 Agricultural Policy Analysis (3 credits)
Also offered as: AREC832. Credit only granted for: AREC632 or AREC832.
The economics of agricultural policies. Methods for analyzing costs and benefits of price supports, import restraints, and other policies for producers, consumers, and taxpayers. Farm programs of the U.S., other industrial countries and developing countries including interventions in both domestic markets and international trade are covered along with their consequences for factor owners and related commodity markets. Theories of the farm problem and possible remedies are offered.

AREC 645 Environment and Development Economics (3 credits)
Also offered as: AREC845. Credit only granted for: AREC645 or AREC845.
Considers neoclassical and endogenous growth models; international trade theory; the role of property right institutions and factor markets; the environmental impact of trade liberalization in developing countries and the environmental effects of increasing international capital mobility; empirical studies relating the environment to growth and globalization; and policy analyses.

AREC 699 Special Problems in Agricultural and Resource Economics (1-2 credits)
Intensive study and analysis of specific problems in the field of agricultural and resource economics, providing in-depth information in areas of special interest to the student.

AREC 783 Environmental Taxation and Regulation (3 credits)
Prerequisite: ECON603 and ECON604; and graduate-level econometrics. Credit only granted for: AREC783 or AREC869W. Formerly: AREC869W.
The economics of policies to address environmental externalities. Specific topics include the theory of public goods and externalities, cost-benefit and cost-effectiveness analysis of environmental regulations, regulatory instrument choice under uncertainty, environmental policy in an economy with pre-existing tax distortions, monitoring and enforcement of environmental regulations, distributional effects of environmental policy, and regulation of intertemporal externalities.

AREC 785 Advanced Economics of Natural Resources (3 credits)
Prerequisite: Permission of AGNR-Agricultural & Resource Economics department; or (ECON603 and AREC623). Also offered as: ECON785. Credit only granted for: AREC785 or ECON785.
The use of exhaustible and renewable natural resources from normative and positive points of view. Analysis of dynamic resource problems emphasizing energy, mineral, groundwater, forestry, and fishery resources; optimal, equilibrium, and intergenerational models of resource allocation.

AREC 799 Master's Thesis Research (1-6 credits)

AREC 815 Experimental and Behavioral Economics (3 credits)
Prerequisite: AREC623, AREC624, ECON603, and ECON604; or equivalent. Credit only granted for: AREC815 or AREC869A. Formerly: AREC869A.
An overview of the design, implementation, and analysis of experiments motivated by behavioral economics, with a particular focus on experiments in field settings. Topics covered include social preferences, risk aversion, prospect theory, present bias, overconfidence, and limited attention.

AREC 825 Advanced Economic Welfare Analysis (3 credits)
Also offered as: AREC625. Credit only granted for: AREC625 or AREC825.
Theory of economic welfare measurement, problems of path dependence in evaluating multiple price changes, welfare measurement under risk, general equilibrium welfare measurement with multiple distortions, and applications in evaluation of agricultural and resource policies.

AREC 829 Topics in Applied Econometrics (3 credits)
Prerequisite: AREC624 and AREC623; or permission of instructor. Repeatable to 9 credits if content differs.
Topics in applied econometrics. Topics vary from year to year.

AREC 832 Advanced Agricultural Policy Analysis (3 credits)
Also offered as: AREC632. Credit only granted for: AREC632 or AREC832.
Research problems in agricultural policy that include models and methods for explaining the consequences and causes of intervention in agricultural commodity markets. Quantitative, market level analysis of the implications of uncertainty, strategic behavior in international trade, second-best policies, the general equilibrium analysis of intervention, and the political economy of collective action in farm policy.

AREC 845 Environment and Development Economics (3 credits)
Also offered as: AREC645. Credit only granted for: AREC645 or AREC845.
Considers neoclassical and endogenous growth models; international trade theory; the role of property right institutions and factor markets; the environmental impact of trade liberalization in developing countries and the environmental effects of increasing international capital mobility; empirical studies relating the environment to growth and globalization; and policy analyses.

AREC 846 Development Microeconomics (3 credits)
Prerequisite: AREC624, ECON603, and AREC623; or equivalent. Formerly: AREC869E.
Development economics with focus on issues applicable to rural development and agriculture in developing countries. Content includes both theory and empirical application of theory. Subjects covered include economics of agricultural households, credit and insurance markets, technological progress and learning and institutional economics of developing countries.

AREC 869 Advanced Topics in Agricultural and Resource Economics (1-3 credits)
Repeatable to 9 credits if content differs.
Frontiers of research in environmental and resource economics; agricultural policy, production, and trade; and development. Topics may include decision making under risk and related market institutions, principal agent analysis, optimal policy design, technology adoption, market structure, land and credit markets, information markets, and income distribution.

AREC 891 Introduction to Prospectus Development (1 credits)
Prerequisite: Completion of the first year of graduate study in AREC. Credit only granted for: AREC 869K or AREC 891. Formerly: AREC869K.
Critical evaluation of research, prospectus topic exploration including literature review, data identification, model development, and related presentations. Required of all second-year Ph.D. students.

AREC 892 Dissertation Prospectus Development (3 credits)
Prerequisite: Completion of two years of the AREC Ph.D. program. Credit only granted for: AREC 869P or AREC 892. Formerly: AREC869P.
Presentations of proposed dissertation research including literature review, model development, data identification, and written prospectus development. Required of all third-year Ph.D. students.

AREC 898 Pre-Candidacy Research (1-8 credits)

AREC 899 Doctoral Dissertation Research (1-8 credits)

Arts and Humanities (ARHU)

ARHU 439 Interdisciplinary Studies in Arts and Humanities (3 credits)
Repeatable to 6 credits if content differs.
An interdisciplinary exploration of chronological, geographical or thematic topics in Arts and Humanities.

ARHU 468 Peer Mentoring Program (1 credits)
Restriction: Sophomore standing or higher; and permission of ARHU-College of Arts & Humanities. Repeatable to 3 credits if content differs.
A workshop for sophomore, junior or senior students who wish to serve as peer mentors helping first-year students to cope with the numerous issues which often arise in the transition to the university.

ARHU 486 Internship Practicum in Arts and Humanities (3-6 credits)
Prerequisite: Have completed previous internship at U of MD. Restriction: Must be in a major in ARHU-College of Arts & Humanities; and permission of ARHU-College of Arts & Humanities; and minimum cumulative GPA of 2.5; and must have earned a minimum of 60 credits; and completed 12 credits at U of MD.
An internship intended for students who have already completed an internship for credit. ARHU486 must be a different experience from the internship students have already taken for credit. Generally students intern with a different company, but they may continue working for the same company if the job is significantly different. See ARHU internship coordinator for details.

ARHU 489 Advanced Internship Practicum in ARHU (3-6 credits)
Prerequisite: ARHU486. Restriction: Must be in a major in ARHU-College of Arts & Humanities; and minimum cumulative GPA of 2.5; and permission of instructor. Repeatable to 6 credits if content differs. Additional information: Course is designed to follow ARHU486.
Designed for students who have already completed at least 2 upper level internship courses for academic credit. It is an advanced practicum to assist students in continuing to develop and hone their professional writing, presentation and analytical skills.

ARHU 498 Special Topics in Arts and Humanities (3 credits)
Repeatable to 6 credits if content differs.

ARHU 786 Leadership and Professional Development Internship (1-6 credits)
Prerequisite: Must have completed one semester of full-time graduate study; and permission of ARHU-College of Arts & Humanities.
Professional development for graduate students interested in careers in non-academic organizations and in administrative positions in academic institutions. See department graduate program director for internship guidelines and applicability to graduate program requirements.

ARHU 788 Profession Development Seminar (1-3 credits)
Repeatable to 9 credits if content differs.
Professional development for academic and non-academic careers in the arts and humanities.

ARHU 789 Professional Development Practicum (1-6 credits)
Restriction: Must have completed at least the equivalent of one year of full-time graduate study; and permission of instructor. Repeatable to 6 credits if content differs.
Graduate students, in various disciplines within the college of Arts and Humanities, will learn the theory and principles of a specific issue or skill set related to academic or non-academic work. They will create original work in a hands-on practicum format.

Army (ARMY)

ARMY 401 Advanced Military Leadership III (3 credits)
Prerequisite: Permission of UGST-Army ROTC. Restriction: Senior standing.
Introduces contracted students to the study of Army structure, practices and processes exercised by Army Commanders and Staff in completing personnel, logistics, training and combat operations. Includes a laboratory in applied leadership skills and two field exercises.

ARMY 402 Advanced Military Leadership IV (3 credits)
Prerequisite: Permission of UGST-Army ROTC. Restriction: Senior standing.
The military system and code of ethics in the military environment is studied. Topics include code of conduct during all forms of military operations, the Geneva Conventions and the ethical decision making process. Also includes a laboratory in applied leadership skills, fitness excellence and two field exercises.

Air Science (ARSC)

ARSC 400 National Security Forces in Contemporary American Society I (3 credits)
Prerequisite: Permission of UGST-AFROTC-Air Science; or (ARSC300 or ARSC301). Corequisite: ARSC059; or permission of UGST-AFROTC-Air Science. Restriction: Senior standing.
Study of American national security policy and processes to include information and implementation, impact of major national and international actors, and development of major policy issues. This course will satisfy credit towards a minor in military studies.

ARSC 401 National Security Forces in Contemporary American Society II (3 credits)
Prerequisite: ARSC300 or ARSC301; or permission of UGST-AFROTC-Air Science. Corequisite: ARSC059; or permission of UGST-AFROTC-Air Science. Restriction: Senior standing.
This course examines various subjects including: military law/justice, preparation for active duty, and current issues affecting military professionalism. This course will satisfy credit towards a minor in military studies.

Art History & Archaeology (ARTH)

ARTH 418 Special Problems in Italian Renaissance Art (3 credits)
Repeatable to 6 credits if content differs.
Focus upon aspects of painting, sculpture, and architecture of Renaissance.

ARTH 426 Renaissance and Baroque Sculpture in Northern Europe (3 credits)
Sculpture in France, Germany, England, and the Low Countries from the fourteenth to the seventeenth century.

ARTH 444 British Painting, Hogarth to the Pre-Raphaelites (3 credits)
A survey of British painting focusing on the establishment of a strong native school in the genres of history painting, narrative subjects, portraiture, sporting art, and landscape.

ARTH 456 Photography Since World War II (3 credits)
Prerequisite: ARTH201. Credit only granted for: ARTH456 or (ARTH489B taken in Spring 2006). Formerly: ARTH489B.
An exploration of the many uses and meanings of photography since 1945.

ARTH 465 The Landscape in Modern and Contemporary Art (3 credits)
Prerequisite: ARTH201. Credit only granted for: ARTH465 or (ARTH489B taken in Spring 2008 or Spring 2009). Formerly: ARTH489B.
A consideration of the representations of outdoor spaces since 1850. Focuses on the ways in which artists have understood and tried to make sense of modern and postmodern cities, suburbs, and rural areas.

ARTH 466 Feminist Perspectives on Women in Art (3 credits)
Principal focus on European and American women artists of the 19th and 20th centuries, in the context of the new scholarship on women.

ARTH 484 Modern Chinese Film and Visual Culture (3 credits)
Also offered as: FILM426. Credit only granted for: ARTH484; ARTH489F in F2012, F2011, F2008, or S2009; or ARTH488F in S2010, S2008, or F2009 or FILM426. Formerly: ARTH489F in F2012, F2011, F2008, or S2009; or ARTH488F in S2010, S2008, or F2009.
Modern Chinese culture, society, and history studied through examples of art, film, and visual culture.

ARTH 485 Chinese Painting (3 credits)
Chinese painting history from the second century B.C. through the twentieth century, covering cultural, stylistic and theoretical aspects.

ARTH 486 Japanese Painting (3 credits)
Japanese painting from the sixth through the nineteenth century, including Buddhist icon painting, narrative scrolls, and Zen-related ink painting.

ARTH 488 Colloquium in Art History (3 credits)
Prerequisite: Permission of ARHU-Art History & Archaeology department. Repeatable to 9 credits if content differs.
Colloquium to investigate a specific topic in depth.

ARTH 489 Special Topics in Art History (3 credits)
Prerequisite: Permission of ARHU-Art History & Archaeology department. Repeatable to 9 credits if content differs.

ARTH 496 Methods of Art History and Archaeology (3 credits)
Prerequisite: Permission of ARHU-Art History & Archaeology department. Restriction: Must be in Art History program.
Methods of research and criticism applied to typical art-historical/ archaeological problems, familiarizing the student with bibliography and other research tools. Introduction to the historiography of art history and archaeology, surveying the principal theories, encouraging methodological debates within the discipline. Course for majors who intend to go on to graduate school.

ARTH 498 Directed Studies in Art History I (2-3 credits)
Prerequisite: Permission of ARHU-Art History & Archaeology department. Restriction: Junior standing or higher. Repeatable to 99 credits if content differs.

ARTH 499 Honors Thesis (1-6 credits)
Prerequisite: Permission of ARHU-Art History & Archaeology department. Repeatable to 6 credits if content differs.

ARTH 608 Studies in Ancient Art and Archaeology (3 credits)
Repeatable to 9 credits.

ARTH 609 Studies in Late Roman, Early Christian, and Byzantine Art (3 credits)
Repeatable to 9 credits.

ARTH 618 Studies in Medieval Art (3 credits)
Repeatable to 9 credits.

ARTH 619 Studies in Italian Renaissance Art (3 credits)
Repeatable to 9 credits.

ARTH 628 Studies in Fourteenth and Fifteenth Century Northern European Art (3 credits)
Repeatable to 9 credits.

ARTH 629 Studies in Sixteenth-Century Northern European Art (3 credits)
Repeatable to 9 credits.

ARTH 638 Studies in Seventeenth-Century Southern European Art (3 credits)
Repeatable to 9 credits.

ARTH 639 Studies in Seventeenth-Century Northern European Art (3 credits)
Repeatable to 9 credits.

ARTH 648 Studies in Eighteenth-Century European Art (3 credits)
Repeatable to 9 credits.

ARTH 649 Studies in Nineteenth-Century European Art (3 credits)
Repeatable to 9 credits.

ARTH 658 Studies in American Art (3 credits)
Repeatable to 9 credits.

ARTH 659 Studies in Twentieth-Century Art (3 credits)
Repeatable to 9 credits.

ARTH 668 Studies in Latin American Art and Archaeology (3 credits)
Repeatable to 9 credits.

ARTH 669 Studies in African Art (3 credits)
Repeatable to 9 credits.

ARTH 678 Studies in Chinese Art (3 credits)
Repeatable to 9 credits.

ARTH 679 Studies in Japanese Art (3 credits)
Repeatable to 9 credits.

ARTH 689 Selected Topics in Art History (1-3 credits)
Repeatable to 9 credits.

ARTH 692 Methods of Art History (3 credits)
Methods of research and criticism applied to typical art-historical problems; bibliography and other research tools.

ARTH 699 Special Topics in Art History (3 credits)
Restriction: Permission of instructor; or permission of ARHU-Art History & Archaeology department.
Prerequisite: consent of department head or instructor.

ARTH 708 Seminar in Ancient Art and Archaeology (3 credits)
Repeatable to 9 credits.

ARTH 709 Seminar in Late Roman, Early Christian, and Byzantine Art (3 credits)
Repeatable to 9 credits.

ARTH 718 Seminar in Medieval Art (3 credits)
Repeatable to 9 credits.

ARTH 719 Seminar in Italian Renaissance Art (3 credits)
Repeatable to 9 credits.

ARTH 728 Seminar in Fourteenth and Fifteenth-Century Northern European Art (3 credits)
Repeatable to 9 credits.

ARTH 729 Seminar in Sixteenth-Century Northern European Art (3 credits)
Repeatable to 9 credits.

ARTH 738 Seminar in Seventeenth-Century Southern European Art (3 credits)
Repeatable to 9 credits.

ARTH 739 Seminar in Seventeenth-Century Northern European Art (3 credits)
Repeatable to 9 credits.

ARTH 748 Seminar in Eighteenth-Century European Art (3 credits)
Repeatable to 9 credits.

ARTH 749 Seminar in Nineteenth-Century European Art (3 credits)
Repeatable to 9 credits.

ARTH 758 Seminar in American Art (3 credits)
Repeatable to 9 credits.

ARTH 759 Seminar in Twentieth-Century Art (3 credits)
Repeatable to 9 credits.

ARTH 768 Seminar in Latin American Art and Archaeology (3 credits)
Repeatable to 9 credits.

ARTH 769 Seminar in African Art (3 credits)
Repeatable to 9 credits.

ARTH 778 Seminar in Chinese Art (3 credits)
Repeatable to 9 credits.

ARTH 779 Seminar in Japanese Art (3 credits)
Repeatable to 9 credits.

ARTH 789 Selected Topics in Art History (1-3 credits)

ARTH 798 Directed Graduate Studies in Art History (3 credits)

ARTH 799 Master's Thesis Research (1-6 credits)

ARTH 898 Pre-Candidacy Research (1-8 credits)

ARTH 899 Doctoral Dissertation Research (1-8 credits)

Art Studio (ARTT)

ARTT 409 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

ARTT 418 Advanced Drawing Studio (3 credits)
Prerequisite: ARTT200, ARTT210, and ARTT150; and must have completed one 300-level studio course. Or permission of ARHU-Art department.
Repeatable to 12 credits.
Multi-level drawing studio emphasizing advanced concepts and processes related to drawing; emphasis on contemporary art issues and individual directions.

ARTT 428 Advanced Painting Studio (3 credits)
Prerequisite: ARTT320. Repeatable to 12 credits.
Multi-level painting studio emphasizing advanced concepts and processes related to oil and acrylic painting; emphasis on contemporary art issues and individual directions in chosen media.

ARTT 438 Advanced Sculpture Studio (3 credits)
Prerequisite: Must have completed one 300-level sculpture course; or permission of ARHU-Art department.
Repeatable to 12 credits.
Multi-level sculpture studio; continuation of media-specific sculpture courses with emphasis on contemporary art issues and individual directions in chosen media.

ARTT 448 Advanced Printmaking Studio (3 credits)
Prerequisite: Must have one 300-level printmaking course; or permission of

ARHU-Art department. Repeatable to 12 credits.
Multi-level printmaking studio; continuation of media-specific printmaking courses with emphasis on contemporary art issues and individual directions in chosen media.

ARTT 449 Advanced Photography Studio (3 credits)
Prerequisite: ARTT353; or permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Advanced photographic processes and theory. Emphasis on contemporary art issues and individual directions.

ARTT 454 Advanced Graphic Design Principles: Design in Society (3 credits)
Prerequisite: ARTT355 and ARTT356.
Focus on social responsibility and community activism. History and theory of propaganda and advocacy-based design. Students explore current design practices, work individually, and collaborate in teams with non-profits or other clients with community-based or socio-cultural agendas. Research and writing-intensive course.

ARTT 455 Three Dimensional Graphic Design (3 credits)
Prerequisite: ARTT355, ARTT356, and ARTT357. Recommended: ARTT333. Credit only granted for: ARTT352 or ARTT455. Formerly: ARTT352.
Continued exploration of advanced graphic design practices with primary emphasis on 3-D object and packaging design. Includes research, course reading discussion, oral presentations, and specific project assignments which will require a proficient level of hand-skills (craft) and computer skills.

ARTT 456 Motion Design (3 credits)
Prerequisite: ARTT355, ARTT356, and ARTT357; or permission of ARHU-Art department.
Explores computer graphics and visual communication principles in a time-based context. Examination of fundamental design principles through digital projects that involve photo manipulation, digital illustration, layout, animation, and web design.

ARTT 457 Advanced Interactive Design (3 credits)
Prerequisite: ARTT357.
Advanced concepts and techniques of interactive design and interactive software. Examination of corporate, client-based, and public service-based interactive graphic design. Emphasis on web-based interactive design structures.

ARTT 458 Graphic Design Portfolio (3 credits)
Prerequisite: ARTT454. Repeatable to 9 credits if content differs.
Creation of a comprehensive professional portfolio. Curriculum includes portfolio preparation and presentation, contracts, copyright issues, interviewing skills, resume and cover-letter writing, design briefs and proposals, and freelance business issues. Portfolio presentation includes basics of book arts.

ARTT 459 Advanced Graphic Design Studio (3 credits)
Prerequisite: ARTT454; or permission of ARHU-Art department. Repeatable to 9 credits if content differs.
Student-run design firm working with non-profits and other organizations. Organizations act as clients; the students as a creative firm. Under guidance and supervision of faculty, students learn first-hand about working with clients, working within a budget, working with printers and press runs, and working under real deadlines.

ARTT 460 Seminar in Art Theory (3 credits)
Restriction: Senior standing.
Exploration of relationship between content and processes of art in a contemporary multi-cultural context.

ARTT 468 Seminar on the Interrelationship Between Art and Art Theory (3 credits)
Restriction: Junior standing or higher; or permission of ARHU-Art department. Repeatable to 6 credits if content differs.
The relationship between a student's work and the theoretical context of contemporary art.

ARTT 469 Professional Practice (3 credits)
Restriction: Senior standing; or permission of ARHU-Art department. Repeatable to 6 credits if content differs. Formerly: ARTT462.
Business aspects of being an artist, with an emphasis on starting and maintaining a professional career.

ARTT 479 Advanced Digital Media Studio (3 credits)
Prerequisite: ARTT370; or permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Variable multi-level studio emphasizing advanced concepts and processes related to time-based, projection, installation, interactive, and audio/visual integrated digital art. Emphasis on contemporary art issues and individual directions.

ARTT 480H Honors Seminar (3 credits)
Team-taught seminar focusing on relationship between student's work and the theoretical context of contemporary art.

ARTT 481 Advanced Specialization Seminar (3 credits)
Prerequisite: Permission of ARHU-Art department.
Seminar combines contemporary art theory, criticism, professional practice and career preparation in relation to students works from all areas of specialization.

ARTT 487 Capstone for Citation in Interdisciplinary Multimedia and Technology (1 credits)
Prerequisite: Permission of ARHU-Art department.
Independent study: a paper or website synthesizing the various citation learning experiences.

ARTT 488 Advanced Special Topics in Graphic Design (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 6 credits if content differs.
Variable topics in Graphic Design theory and practice.

ARTT 489 Advanced Special Topics in Art (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Development of student's work on an advanced studio level within the context of a special topic.

ARTT 498 Directed Studies in Studio Art (1-3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Advanced independent work in Studio Art. Meeting with faculty and studio time arranged.

ARTT 499 Directed Studies in Graphic Design (1-3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Advanced independent studies in Graphic Design. Meetings with faculty and studio time arranged.

ARTT 618 Drawing (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in drawing for advanced special students.

ARTT 628 Painting (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Graduate painting for advanced special students.

ARTT 638 Sculpture (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in sculpture for advanced special students.

ARTT 648 Printmaking (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in printmaking for advanced special students.

ARTT 689 Special Problems in Studio Art (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits. Formerly: ARTS689.

ARTT 698 Directed Graduate Studies in Studio Art (1-4 credits)
Prerequisite: Permission of ARHU-Art department. Restriction: Must be in Studio Art (Master's) program. Repeatable to 12 credits if content differs. Formerly: ARTS698.
Independent work. Meetings with faculty and studio time arranged.

ARTT 699 Directed Graduate Studies in Studio Art (1-4 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits.
Independent graduate studies.

ARTT 718 Drawing (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in drawing for advanced special students.

ARTT 728 Painting (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in painting for advanced special students.

ARTT 738 Sculpture (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in sculpture for advanced special students.

ARTT 748 Printmaking (3 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Independent studies in printmaking for advanced special students.

ARTT 768 Graduate Colloquium (2 credits)
Prerequisite: Permission of ARHU-Art department. Repeatable to 12 credits if content differs.
Examines various aspects of art, art theory and criticism in a contemporary and multi-cultural context. Relates student work to this context.

ARTT 798 Directed Graduate Studies in Studio Art (1-4 credits)
Restriction: Must be in Studio Art (Master's) program. Repeatable to 12 credits if content differs. Formerly: ARTS798.
Independent graduate studies.

ARTT 799 Master's Thesis Research (1-6 credits)
Formerly: ARTS799.

Astronomy (ASTR)

ASTR 410 Radio Astronomy (3 credits)
Prerequisite: ASTR121; and (PHYS271 and PHYS270; or PHYS273). Or permission of CMNS-Astronomy department.
Introduction to current observational techniques in radio astronomy. The radio sky, radiophysics, coordinates and catalogs, antenna theory, Fourier transforms, interferometry and arrays, aperture synthesis, and radio detectors.

ASTR 415 Computational Astrophysics (3 credits)
Prerequisite: ASTR121; and (PHYS271 and PHYS270; or PHYS273). Or permission of CMNS-Astronomy department.
Introduction to the most important computational techniques being used in research in astrophysics. Topics include modern high performance computer architectures, scientific visualization and data analysis, and detailed descriptions of numerical algorithms for the solution to a wide range of mathematical systems important in astrophysics.

ASTR 421 Galaxies (3 credits)
Prerequisite: ASTR121; and (PHYS271 and PHYS270; or PHYS273). Or permission of CMNS-Astronomy department.
Introduction to structure, kinematics, and dynamics of normal and peculiar galaxies. Quantitative descriptions of normal spiral galaxies (like our Milky Way) and elliptical galaxies will be followed by more exotic considerations such as interacting and merging galaxies, and active galactic nuclei.

ASTR 422 Cosmology (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in ASTR320; or permission of CMNS-Astronomy department.
Introduction to modern cosmology. Topics include large scale structure of universe, the intergalactic medium, the nature of dark matter cosmological models and galaxy formation.

ASTR 430 The Solar System (3 credits)
Prerequisite: ASTR121; and (PHYS271 and PHYS270; or PHYS273). Or permission of CMNS-Astronomy department.
Formation and evolution of the Solar System. Planetary surfaces, interiors, atmospheres, and magnetospheres. Asteroids, comets, planetary satellites, and ring systems. Emphasis on using basic physics to understand observed properties of the Solar System. Intended for students majoring in the physical sciences.

ASTR 450 Orbital Dynamics (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in ASTR320; or permission of CMNS-Astronomy department.
Vectorial mechanics, motion in a central force field, gravitational and non-gravitational forces, the two-body and three-body problems, orbital elements and orbital perturbation theory, resonances in the solar system, chaos. Intended for students majoring in any of the physical sciences.

ASTR 480 High Energy Astrophysics (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in ASTR320; or permission of CMNS-Astronomy department.
The structure, formation, and astrophysics of compact objects, such as white dwarfs, neutron stars, and black holes, are examined. Phenomena such as supernovae and high-energy particles are also covered.

ASTR 498 Special Problems in Astronomy (1-6 credits)
Restriction: Must be in one of the following programs (Physics; Astronomy) ; and permission of CMNS-Astronomy department.
Research or special study. Credit according to work done.

ASTR 601 Radiative Processes (3 credits)
Restriction: Permission of CMNS-Astronomy department.
Emission, absorption, and scattering of radiation by matter, with astrophysical

applications. Thermodynamics and statistical mechanics: LTE, Boltzmann, and Saha equations; radiative transfer; atomic and molecular radiation; plasma radiation and transfer: bremsstrahlung, synchrotron emission, Compton scattering.

ASTR 606 Stellar Structure and Evolution (3 credits)
Prerequisite: ASTR601; or permission of CMNS-Astronomy department.
Models of stellar atmospheres, methods of determinins properties of stars, physical principles governing stellar interior processes, observational data for determining stellar evolution, nuclear processes, stellar modeling.

ASTR 610 Astronomical Instrumentation and Techniques (3 credits)
Restriction: Permission of CMNS-Astronomy department.
Review of Maxwell's equations; designs of telescopes, spectrographs, modern detectors; basic concepts for radio detectors and telescopes; interferometry and data processing.

ASTR 615 Computational Astrophysics (3 credits)
Restriction: Permission of CMNS-Astronomy department. Formerly: ASTR688C.
Introduction to computational techniques used in astrophysical research. Topics include modern high performance computer architectures, scientific visualization and data analysis, and detailed descriptions of numerical algorithms for the solution to a wide range of mathematical systems important in astrophysics.

ASTR 620 Galaxies (3 credits)
Restriction: Permission of CMNS-Astronomy department.
Galaxy classifications; Milky way: basic data, distribution of stars, gas, dust and relativistic particles, large-scale structure and rotation; Spiral galaxies: stellar dynamics and stability, density waves, star bursts, galactic center; Elliptical galaxies: stellar dynamics, cannabalism; galaxy formation.

ASTR 622 Cosmology (3 credits)
Restriction: Permission of CMNS-Astronomy department. Credit only granted for: ASTR622 or ASTR688R. Formerly: ASTR688R.
Introduction to modern cosmology. Topics include the large scale structure of the universe, cosmological models, the Big Bang, the cosmic microwave background, the nature of dark matter, and galaxy formation.

ASTR 630 Planetary Science (3 credits)
Restriction: Permission of CMNS-Astronomy department. Credit only granted for: ASTR630 or ASTR688P. Formerly: ASTR688P.
The science of our planetary system with an emphasis on the aspects of it, that help us understand the origin of the system and thus the relevance to other planetary systems. Topics will include planetary atmospheres, surfaces, and interiors and the small bodies of the solar system (asteroids, comets, Kuiper-belt objects). We will consider the dynamics of these bodies and the physics and chemistry of these bodies.

ASTR 670 Interstellar Medium and Gas Dynamics (3 credits)
Prerequisite: ASTR601; or permission of CMNS-Astronomy department.
Content of phases of the interstellar medium: physical processes in the ISM: ionization equilibrium, heating and cooling, interstellar dust; gas dynamics: fluid motions, instabilities, shock waves; magnetohydrodynamics.

ASTR 680 High Energy Astrophysics (3 credits)
Restriction: Permission of CMNS-Astronomy department. Formerly: ASTR688M.
The structure, formation, and astrophysics of compact objects, such as white dwarfs, neutron stars, and black holes, are examined.

ASTR 688 Special Topics in Modern Astronomy (1-3 credits)
Restriction: Permission of instructor.
Special topics such as extragalactic radio sources, plasma astrophysics, the H.R. diagram, chemistry of the interstellar medium, radiophysics of the sun.

ASTR 690 Reasearch Project I (3 credits)

ASTR 695 Introduction to Research (1 credits)
Provides an introduction to research programs in the Department of Astronomy and a forum to explore possible research projects. Aimed at incoming graduate students.

ASTR 699 Special Problems in Advanced Astronomy (1-6 credits)

ASTR 788 Selected Topics in Modern Astronomy (1-3 credits)

ASTR 799 Master's Thesis Research (1-6 credits)

ASTR 898 Pre-Candidacy Research (1-8 credits)

ASTR 899 Doctoral Dissertation Research (1-8 credits)

Biochemistry (BCHM)

BCHM 461 Biochemistry I (3 credits)
Prerequisite: Minimum grade of C- in CHEM271 and CHEM272; or minimum grade of C- in CHEM276 and CHEM277. Credit only granted for: BCHM461 or BCHM463.
First semester of a comprehensive introduction to modern biochemistry. Structure, chemical properties, and function of proteins and enzymes, carbohydrates, lipids, and nucleic acids. Basic enzyme kinetics and catalytic mechanisms.

BCHM 462 Biochemistry II (3 credits)
Prerequisite: Minimum grade of C- in BCHM461. Credit only granted for: BCHM462 or BCHM463.
A continuation of BCHM 461. Metabolic pathways and metabolic regulation, energy transduction in biological systems, enzyme catalytic mechanisms.

BCHM 463 Biochemistry of Physiology (3 credits)
Prerequisite: Minimum grade of C- in CHEM271 and CHEM272; or minimum grade of C- in CHEM276 and CHEM277. Credit only granted for: BCHM461, BCHM462 or BCHM463.
A one-semester introduction to general biochemistry. A study of protein structure, enzyme catalysis, metabolism, and metabolic regulation with respect to their relationship to physiology.

BCHM 464 Biochemistry Laboratory (3 credits)
Prerequisite: BCHM461 or BCHM463; and a grade of C- or better in the prerequisite is required for all College of Computer, Mathematical, and Natural Sciences majors and recommended for all students. Corequisite: BCHM465. Restriction: BCHM, CHEM, and Nutritional Sciences majors have first priority, followed by other life science majors.
Biochemical and genetic methods for studying protein function. Site-directed mutagenesis and molecular cloning, protein purification, enzyme activity assays, computer modeling of protein structure.

BCHM 465 Biochemistry III (3 credits)

Prerequisite: BCHM461 or BCHM463; and a grade of C- or better in the prerequisite is required for College of Computer, Mathematical, and Natural Sciences majors and recommended for all students. Recommended: BCHM462.
CORE Capstone (CS) Course. An advanced course in biochemistry. Biochemical approach to cellular information processing. DNA and RNA structure. DNA replication, transcription, and repair. Translation of mRNA to make proteins.

BCHM 485 Physical Biochemistry (3 credits)
Prerequisite: Minimum grade of C- in CHEM481. Restriction: Must be in Biochemistry program; or permission of instructor. Credit only granted for: CHEM482 or BCHM485.
Physical Chemistry with applications to biological systems. Principal topics: quantum chemistry, spectroscopy, structural methods for biological macromolecules, statistical thermodynamics, transport processes in liquid phase, chemical and biochemical kinetics, modeling and simulation, polymer dynamics.

BCHM 661 Nucleic Acids I (2 credits)
Prerequisite: BSCI410 and BCHM465.
Topics covered: Chemistry and structure of DNA and RNA, from nucleotides to chromatin, chromosomes, and genomes, and some methods for studying, synthesizing, sequencing and manipulating nucleic acids. Rudimentary genomics and bioinformatics. DNA Biology: selected aspects of the biochemistry and regulation of DNA replication, repair, and recombination, and how these processes interact with each other.

BCHM 662 Nucleic Acids II (2 credits)
Prerequisite: BCHM661.
Topics covered: Interactions between nucleic acids and ligands such as cations, drugs, and especially proteins. Sources of binding affinity and specificity. Selection-amplification methods. Description of several classes of protein-nucleic acids complexes. DNA/RNA catalysis, the origin of life, mobile genetic elements.

BCHM 668 Special Problems in Biochemistry (2-4 credits)
Prerequisite: BCHM464; or students who have taken courses with comparable content may contact the department.

BCHM 669 Special Topics in Biochemistry (1-3 credits)
Prerequisite: BCHM462; or students who have taken courses with comparable content may contact the department.

BCHM 671 Protein Chemistry and Enzymic Catalysis (3 credits)
Prerequisite: BCHM461; or students who have taken courses with comparable content may contact the department.
Principles of protein structure, folding, and function, experimental characterization of structure, active sites, enzyme mechanisms and kinetics.

BCHM 673 Regulation of Metabolism (3 credits)
Prerequisite: BCHM462 or BCHM463; or students who have taken courses with comparable content may contact the department.
Intracellular milieu, compartmentation, metabolic and enzymic approaches to identifying control points, regulation by covalent modification of enzymes, metabolic disorders.

BCHM 674 Nucleic Acids (3 credits)
Prerequisite: BSCI410; or students who have taken courses with comparable content may contact the department.
Chemistry of nucleotides and polynucleotides, sequencing and organization of genomes, experimental methods. DNA replication, repair, and recombination. RNA synthesis and processing, regulation of gene expression.

BCHM 675 Biophysical Chemistry (3 credits)
Prerequisite: CHEM481 and BCHM461; or students who have taken courses with comparable content may contact the department.
Conformation, shape, structure, conformational changes, dynamics and interactions of biological macromolecules and complexes or arrays of macromolecules. Physical techniques for studying properties of biological macromolecules.

BCHM 676 Biological Mass Spectrometry (3 credits)
Prerequisite: BCHM461 or BCHM463. Formerly: BCHM669B.
Fundamentals of modern mass spectrometry and use with biochemical techniques to provide unique analyses of drug metabolites, lipids, carbohydrates, nucleotides and proteins. The interface with bioinformatics will be examined, which provides the foundation of proteomics.

BCHM 677 Computational Tools in Biochemistry (1 credits)
Prerequisite: BCHM674 or BCHM671; or permission of instructor. Restriction: Must be in one of the following programs (Biochemistry (Master's); Biochemistry (Doctoral)) ; or permission of instructor.
A practical, hands-on introduction to the application of computational tools that support biochemistry research. Selected topics may include: efficient use of scientific literature databases and the preparation of professional bibliographies; proteomics and mass spectrometry; bioinformatics and genomics programs an database resources; molecular structure visualization and modeling; quatitative data fitting and error analysis; and laboratory research ethics.

BCHM 698 Literature Seminar in Biochemistry (2 credits)
Repeatable to 2 credits if content differs.
Students will prepare and present a departmental seminar based on a topic in the current biochemical research literature.

BCHM 699 Special Problems in Biochemistry (1-6 credits)
Prerequisite: Must have completed one semester of graduate study in biochemistry; and must be in the Biochemistry Masters program non-thesis M.S. option. Repeatable to 6 credits if content differs.
Laboratory experience in a research environment. Restricted to students in the non-thesis M.S. option.

BCHM 799 Master's Thesis Research (1-6 credits)

BCHM 889 Seminar (1-3 credits)

BCHM 898 Pre-Candidacy Research (1-8 credits)

BCHM 899 Doctoral Dissertation Research (1-8 credits)

Behavior, Ecology, Evolution and Systematics (BEES)

BEES 608 Seminar in Behavior, Ecology, Evolution and Systematics (1-4 credits)
Repeatable to 15 credits if content differs.
One seminar per week for each subject selected: Behavior; Ecology; Evolution; Systematics; Behavior, Ecology, Evoultion and Systematics.

BEES 609 Special Topics in Behavior, Ecology, Evolution and Systematics (1-6 credits)

Repeatable to 12 credits if content differs.
Lectures, experimental courses and other special instructions in topics appropriate for Behavior, Ecology, Evolution and Systematics (BEES) students.

BEES 708 Advanced Topics in Behavior, Ecology, Evolution, and Systematics (1-4 credits)
Repeatable to 12 credits if content differs.
Lectures, experimental courses, and other special instruction in various behavioral, ecology, evolution and systematics subjects.

BEES 799 Master's Thesis Research (1-6 credits)

BEES 898 Pre-Candidacy Research (1-8 credits)

BEES 899 Doctoral Dissertation Research (1-8 credits)

Bioengineering (BIOE)

BIOE 404 Biomechanics (3 credits)
Prerequisite: MATH246, BIOE120, ENES102, BIOE121, and BIOE241; and permission of ENGR-Fischell Department of Bioengineering department. Restriction: Must be in Engineering: Bioengineering program.
Introduction to the fundamentals of biomechanics including force analysis, mechanics of deformable bodies, stress and strain, multiaxial deformations, stress analysis, and viscoelasticity. Biomechanics of soft and hard tissues.

BIOE 411 Tissue Engineering (3 credits)
Prerequisite: Must have completed at least one biology course; and MATH241. Recommended: BSCI330 and BIOE340. Also offered as: CHBE487. Credit only granted for: BIOE411 or CHBE487.
A review of the fundamental principles involved in the design of engineered tissues and organs. Both biological and engineering fundamentals will be considered.

BIOE 420 Bioimaging (3 credits)
Prerequisite: MATH246, BIOE120, BIOE121, and BIOE241; and permission of ENGR-Fischell Department of Bioengineering department. Restriction: Must be in Engineering: Bioengineering program.
Examines the physical principles behind major biomedical imaging modalities and new ways of using images for bio-related applications.

BIOE 422 Biosystems Engineering (3 credits)
Prerequisite: BIOE120 and BIOE121; or BSCI105. And (ENME331, BIOE331, ENCE305, or BIOE332).
Conservation of mass in the context of biological systems at different scales (i.e., cellular, organ, and ecosystem), life cycles such as carbon cycle, nitrogen cycle, photosynthesis, water cycle, Kreb cycle, and aerobic and anaerobic cycles as they relate to biosystem function and health.

BIOE 425 Mechanical Properties of Biological Tissues (3 credits)
Prerequisite: ENES220 and MATH241.
An exploration of mechanical properties of living biological tissues; including hard and soft tissues. Coverage will include all the traditional mechanical properties applied to biological tissues, including: stress-strain behavior, elastic, viscoelastic, thermomechanical, fracture, fatigue, etc. Additionally, alteration of mechanical properties of living tissues due to disease, development, growth, and remodeling will be covered.

BIOE 431 Fundamentals of Biosensor Techniques, Instrumentation, and Applications (3 credits)
Prerequisite: CHEM135, PHYS161, PHYS261, and BSCI330. Restriction: Permission of ENGR-Fischell Department of Bioengineering department.
A thorough review of fundamental concepts of biosensing systems, principles of common detection methods, and modern applications of biosensors. Primarily literature driven. Students will obtain a detailed understanding of cutting-edge biosensing techniques, the instrumentation used, and the application space. Students also will develop skills in using current literature as a source of knowledge.

BIOE 432 Fundamentals of Biophotonics Imaging and Microscopy (3 credits)
Prerequisite: PHYS270 and BIOE420. Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE432, BIOE632, or BIOE689C.
Principles and instrumentation of various biomedical optical techniques, including fluorescene and Raman spectroscopy, confocal and multi-photon microscopy, optical coherence tomography, and diffuse optical tomography. Biomedical aplications will also be discussed.

BIOE 450 Fundamentals of Quantitative Cell Physiology (3 credits)
Recommended: MATH246, MATH141, and MATH241. Restriction: Permission of ENGR-Fischell Department of Bioengineering department.
Introduction to neuronal and muscle electrophysiology. Topics include theoretical modeling of electrical properties of the cell, experimental approaches to cell electrophysiology and details on the biological basis for cell electrical function.

BIOE 453 Biomaterials (3 credits)
Prerequisite: CHEM231, MATH246, CHEM232, BIOE120, BIOE121, and BIOE241. Corequisite: BIOE454. Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Also offered as: ENMA425. Credit only granted for: ENBE453, BIOE453, or ENMA425. Formerly: ENBE453.
Examination of the structure and function of natural biomaterials, and cell-extracellular matrix interactions. Study physical properties of synthetic biomaterials for biomedical applications. Understanding molecular level interactions between biomolecules and biomaterials to design novel biomaterials with desirable characteristics. Application of biomaterials as implants, drug delivery systems, biosensors, engineered materials such as artificial skin and bone growth scaffolds will be covered.

BIOE 454 Biomaterials Laboratory (1 credits)
Prerequisite: CHEM231, MATH246, CHEM232, BIOE120, BIOE121, and BIOE241. Corequisite: BIOE453. Recommended: ENES220. Restriction: Permission of ENGR-Fischell Department of Bioengineering department.
Hands-on experience with measurements of bulk and surface properties of biological materials, synthesis of hydrogel, surface patterning using soft lithography technique, and preparation of 3D agarose matrix of cell culture. The topics cover measurements of tensile strength, hardness, and impact strength of the biomaterials, swelling and transport behavior of hydrogel, patterning silicon substrate using self-assembled monolayer, and cell-biomaterials interactions in scaffold biomaterials.

BIOE 455 Basic Electronic Design (3 credits)
Prerequisite: MATH246, BIOE120, BIOE121, and BIOE241. Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE455 or ENBE455. Formerly: ENBE455.
Familiarization with basic electronic circuits and the ability to produce simple electronic designs.

BIOE 456 Bioinstrumentation (3 credits)
Prerequisite: BIOE455. Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE456 or ENBE456. Formerly: ENBE456.
Study of biomedical instrumentation and biomedical equipment technology. How biomedical equipment is used to measure information from the human body. Hands-on experience with representative biomedical equipment.

BIOE 457 Biomedical Electronics & Instrumentation (4 credits)
Prerequisite: BIOE120, BIOE121, BIOE241, and PHYS261. Restriction: Permission of ENGR-Fischell Department of Bioengineering department.
Students learn fundamental concepts of electronics, assembly of electronic components into functional circuits, and integration of functional electronic devices and circuits into a system. In the lab component, students will learn to assemble and evaluate circuits and systems.

BIOE 460 Biotechnology and Bioproduction (3 credits)
Restriction: Junior standing or higher. Credit only granted for: BIOE460, BIOE468B, or ENES489Q. Formerly: BIOE468B.
Basics of recombinant DNA technology and biopharmaceutical manufacturing.

BIOE 461 Synthetic Biology and Biological Engineering (3 credits)
Recommended: Completion of BSCI222 and/or BSCI330 recommended. Restriction: Must be in a major within the ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE489G or BIOE 461. Formerly: BIOE489G.
Students are introduce to the scientific foundation and concepts of synthetic biology and biological engineering. Current examples that apply synthetic biology to fundamental and practical challenges will be emphasized. The course will also address the societal issues of synthetic biology, and briefly examine interests to regulate research in this area.

BIOE 468 Selected Topics in Bioengineering (3 credits)
Prerequisite: BIOE120 and BIOE121. Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Repeatable to 9 credits if content differs.
Selected topics in Bioengineering will be covered and taught by a variety of department faculty.

BIOE 471 Biological Systems Control (3 credits)
Prerequisite: BIOE455. Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE471 or ENBE471. Formerly: ENBE471.
Principles of control systems designed by biological engineers and analysis of control mechanisms found in biological organisms. Apparent control strategies used by biological systems will be covered.

BIOE 484 Engineering in Biology (3 credits)
Prerequisite: MATH221 or MATH141; and (PHYS141 or PHYS161); and must have completed CHEM103 or higher. Or permission of ENGR-Fischell Department of Bioengineering department. Recommended: BIOE454. Credit only granted for: BIOE484 or ENBE484. Formerly: ENBE484.
Engineering with biological systems, with emphasis on utilization, design, and modeling. Broad topics include differences between biological engineering and biological science; basic sciences and how they relate to biology; typical biological responses to environmental stimuli; scaling, and utilization of living things.

BIOE 485 Capstone Design I: Entrepreneurship, Regulatory Issues, and Ethics (3 credits)
Prerequisite: 21 credits in BIOE courses. Restriction: Permission of ENGR-Fischell Department of Bioengineering department; and senior standing; and must be in Engineering: Bioengineering program. Credit only granted for: BIOE485 or ENBE485. Formerly: ENBE485.
This is the first part of a two-semester senior capstone design course which covers principles involved in engineering design, design approaches, economics of design, ethics in engineering, and patent regulations. It also helps students learn team work and write design project proposals under the mentorship of a faculty advisor.

BIOE 486 Capstone Design II (3 credits)
Prerequisite: Must have completed BIOE485 in the immediately preceding semester. Restriction: Senior standing; and must be in Engineering: Bioengineering program; and permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE486 or ENBE486. Formerly: ENBE486.
This is the second part of the senior capstone design course. This part is independent instruction where faculty mentoring each project team works with students to order supplies, fabricate their proposed design under BIOE485, test the design, write the report and present it to their fellow seniors and board of faculty mentors. Students are taught to convert the blue print of a design to actual device and test it.

BIOE 489 Special Topics in Bioengineering (1-3 credits)
Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Repeatable to 6 credits.
Exploring a variety of topics with Bioengineering.

BIOE 601 Biomolecular and Cellular Rate Processes (3 credits)
Credit only granted for: BIOE601 or ENCH859B.
Presentation of techniques for characterizing and manipulating non-linear biochemical reaction networks. Advanced topics to include mathematical modeling of the dynamics of biological systems; separation techniques for heat sensitive biologically active materials; and rate processes in cellular and biomolecular systems. Methods are applied to current biotechnological systems, some include: recombinant bacteria; plant insect and mammalian cells; and transformed cell lines.

BIOE 602 Cellular and Tissue Biomechanics (3 credits)
Introduction to the fundamentals of biomechanics including force analysis, mechanics of deformable bodies, stress and strain, multiaxial deformations, stress analysis, and viscoelasticity. Biomechanics of soft and hard tissues.

BIOE 603 Quantitative Cell Physiology (3 credits)
Introduction to neuromuscular electrophysiology. Topics include theoretical modeling of electrical properties of the cell, experimental approaches to cell electrophysiology, and details on the biological basis for cell electrical function.

BIOE 604 Cellular and Physiological Transport Phenomena (3 credits)
A study of transport processes, including momentum, energy and mass transport, relevant to biosystems at various scales from physiological to cellular systems. Transport leads to sets of partial differential equations and the course revolves around approaches to solving these equations to arrive at fundamental understanding of the physics of transport in biosystems.

BIOE 605 BIOE Graduate Studies I (1 credits)
Restriction: Must be in ENGR: PhD Only-Bioengineering (Doctoral) program.
Introduction to the bioengineering graduate program. Students gain exposure to departmental research through lab rotation and to current research in the field through seminar. Students will also gain preparation and guidance on other first-year academic requirements.

BIOE 606 BIOE Graduate Studies II (1 credits)
Restriction: Must be in ENGR: PhD Only-Bioengineering (Doctoral) program.
Second semester continued acclimation to the bioengineering graduate program. Students gain exposure to departmental research through lab rotation and to current research in the field through seminar.

BIOE 608 Bioengineering Seminar Series (1 credits)
Restriction: Must be in one of the following programs (ENGR: PhD Only-Bioengineering (Master's); ENGR: PhD Only-Bioengineering (Doctoral)). Repeatable to 6 credits if content differs.
A variety of topics related to Bioengineering will be presented in weekly seminars.

BIOE 611 Advanced Tissue Engineering (3 credits)
Prerequisite: Must have completed at least one biology course; and MATH241. Recommended: BSCI330 and BIOE340.
A review of the fundamental principles involved in the design of engineered tissues and organs. Both biological and engineering fundamentals will be considered.

BIOE 612 Physiological Evaluation of Bioengineering Designs (3 credits)
Bioengineering designs of biomaterials, biomedical devices, imaging and drug delivery agents, tissue engineering, prosthesis (among others), offer the opportunity to improve health care. This course is aimed at providing knowledge to lead bioengineering designs on the basis of biocompatibility and to provide tools to assess their patho-physiological impact in biological systems.

BIOE 614 Computational Molecular Bioengineering (3 credits)
Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE689D or BIOE614. Formerly: BIOE689D.
Introduction to the principles, methods and software used for simulation and modeling of macromolecules of biological interest. Along with experiment and theory, computational modeling provides new tools for analysis, explanation and prediction.

BIOE 631 Biosensor Techniques, Instrumentation, and Applications (3 credits)
Prerequisite: Permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE631, BIOE689Z, or CHPH718Z. Formerly: BIOE689Z.
A thorough review of fundamental concepts of biosensing systems, principles of common detection methods, and modern applications of biosensors. Primarily literature driven. Students will obtain a detailed understanding of cutting-edge biosensing techniques, the instrumentation used, and the application space. Students also will develop skills in using current literature as a source of knowledge.

BIOE 632 Biophotonic Imaging and Microscopy (3 credits)
Prerequisite: PHYS270 and BIOE420; and permission of ENGR-Fischell Department of Bioengineering department. Credit only granted for: BIOE432, BIOE632, or BIOE689C.
Principles and instrumentation of various biomedical optical techniques, including fluorescene and Raman spectroscopy, confocal and multi-photon microscopy, optical coherence tomography, and diffuse optical tomography. Biomedical aplications will also be discussed.

BIOE 640 Polymer Physics (3 credits)
Prerequisite: ENMA471; or permission of instructor. Also offered as: ENMA620. Credit only granted for: ENMA620 or BIOE640.
Graduate course covering theoretical aspects of the behavior of polymeric materials. It covers statistical properties and thermodynamics of single chain and multichain systems.

BIOE 645 Advanced Engineering Start Up Ventures (3 credits)
Covers principles and practices important to engineering startup ventures, especially those involving bioengineering and medical device enterprises, and includes the preparation of business plans and tools used to obtain funding.

BIOE 650 Quantitative Physiology of the Cell (3 credits)
Recommended: MATH246, MATH141, and MATH241. Credit only granted for: BIOE689Q or BIOE650. Formerly: BIOE689Q.
Introduction to quatitative aspects of neuronal, skeletal muscle, and cardiac physiological systems, with an emphasis on cellular function and plasticity. Complements BIOE603: Electrophysiolgy of the Cell.

BIOE 653 Advanced Biomaterials (3 credits)
Restriction: Permission of ENGR-Fischell Department of Bioengineering department. Also offered as: ENMA625. Credit only granted for: ENMA625 or BIOE653.
Examine the relationship between structure and function of biomaterials. Study physical properties of synthetic and natural biomaterials. Understand molecular level interactions between biomolecules and biomaterials to design novel biomaterials with desirable characteristics. Application of biomaterials as implants, drug delivery systems, biosensors, and scaffold materials for tissue engineering will be covered.

BIOE 689 Special Topics in Bioengineering (1-3 credits)
Repeatable to 6 credits if content differs.
Research Oriented Individual Instruction course.

BIOE 799 Master's Thesis Research (1-6 credits)

BIOE 898 Pre-Candidacy Research (1-8 credits)

BIOE 899 Doctoral Dissertation Research (1-8 credits)

Biology (BIOL)

BIOL 502 Life Science for Middle School Teachers II (4 credits)
A second-level lecture/laboratory course that provides a general introduction to the classification, anatomy and physiology of plants and animals, with a special emphasis on humans.

BIOL 503 Life Science for Middle School Teachers III (4 credits)
Prerequisite: BIOL502.
A third-level laboratory/field course that investigates the ecology and natural history of the Chesapeake Bay and human's relationship to it.

BIOL 600 Ethics in Scientific Research (2 credits)
Restriction: Must have completed at least one year of graduate study. Credit only granted for: BIOL600 or ZOOL600. Formerly: ZOOL600.
Issues of sceintific integrity with emphasis on investigators in the laboratory

sciences, including mentoring, scientific record keeping, authorship and peer review, ownership of data, use of animals and humans in research, and conflict of interest.

BIOL 608 Biology Seminar (1-2 credits)
Repeatable to 8 credits if content differs. Formerly: ZOOL608.

BIOL 609 Special Problems in Biology (1-6 credits)
Repeatable to 6 credits if content differs. Formerly: ZOOL609.
One seminar per week for each subject selected: A-Cell Biology; B-Developmental Biology; C-Estuarine and Marine Biology; D-Genetics; E-Parasitology; F-Physiology; G-Systematics and Evolutionary Biology; I-Behavior; J-General; K-Endocrinology; L-Ecology.

BIOL 613 Recombinant DNA (3 credits)
Prerequisite: BSCI330 or BSCI230; and BSCI222. Or permission of instructor required. Credit only granted for: BIOL613 or ZOOL652. Formerly: ZOOL652.
An advanced course presenting the tools and procedures of genetic engineering. Theory and practical applications of recombinant DNA techniques to understanding eukaryotic gene structure and expression.

BIOL 615 Developmental Genetics (3 credits)
Prerequisite: Must have completed courses in molecular genetics and developmental or cell biology; or permission of instructor. Credit only granted for: BIOL615 or ZOOL642. Formerly: ZOOL642.
Differential gene function and its regulation in developing systems. Genes and the analysis of developmental processes.

BIOL 620 Cell Biology (3 credits)
Offered with laboratory as BSCI 421. Molecular basis of cell structure and function in eukaryotes.

BIOL 622 Membrane Transport Phenomena (3 credits)
Prerequisite: MATH220; and (BSCI330 or BSCI230). Or permission of instructor. Credit only granted for: BIOL622 or ZOOL622. Formerly: ZOOL622.
The fundamental phenomena related to solute movement in bulk solution and across interfaces. Examination of natural and artificial membrane transport systems, with emphasis placed on their mechanism of action.

BIOL 625 Biological Ultrastructure (3 credits)
Prerequisite: Must have completed a course in Cell Biology or Histology; or permission of instructor. Credit only granted for: BIOL625 or ZOOL615. Formerly: ZOOL615.
The ultrastructure of cells and tissues, with emphasis on interpretation and correlation of ultrastructure and function.

BIOL 641 Comparative Physiology (4 credits)
Prerequisite: One year of biology, one year of organic chemistry, and one semester of physiology. Credit only granted for: BIOL641 or ZOOL621. Formerly: ZOOL621.
Cellular and biochemical processes used by animals to interact with both the external and cellular environment. Water balance, intermediary metabolism, nitrogen metabolism, anaerobic metabolism, thermal regulation, nerve and muscle physiology in cells from a broad variety of animal species are considered.

BIOL 646 Hearing (3 credits)
Prerequisite: BSCI330 or BSCI230; or permission of instructor. Credit only granted for: BIOL646 or ZOOL636. Formerly: ZOOL636.
Principles of hearing, covering the auditory periphery, the physiology and anatomy of the central auditory system and psychoacoustics.

BIOL 651 Physical Chemistry for Biologists (3 credits)
Mechanistic and quantitative aspects of chemical and physical processes, including diffusion, ligand-receptor binging, DNA melting, sedimentation, redox reactions, kinetics, fluorescence, osmosis and electrophoresis.

BIOL 660 Theoretical Population and Community Ecology (3 credits)
Prerequisite: Must have completed one year of college calculus. And BSCI462; or students who have taken courses with comparable content may contact the department. Credit only granted for: BIOL660 or ZOOL675. Formerly: ZOOL675.
Application of simple dynamic systems and optimization models to understand the dynamics of populations and ecological communities; population growth, predator-prey interactions, competition, food webs, foraging theory, and evolution of life histories. Instruction and use of the program Mathematica.

BIOL 662 Concepts in Animal Ecology (4 credits)
Prerequisite: BSCI462; or students who have taken courses with comparable content may contact the department; or must have completed a course in ecology. Credit only granted for: BIOL662 or ZOOL670. Formerly: ZOOL670.
A graduate-level treatment of ecological processes and their evolutionary implications. Review of classical and contemporary literature, with emphasis on current developments in ecological theories, and their testing in the laboratory and in the field.

BIOL 665 Behavioral Ecology (4 credits)
Prerequisite: Must have completed a course in ecology; and must have completed a course in behavior. Or permission of instructor. Credit only granted for: BIOL665 or ZOOL676. Formerly: ZOOL676.
Use of evolutionary theory to study life history and social behavior in animals and humans.

BIOL 667 Mathematical Biology (4 credits)
Credit only granted for: BIOL667 or ZOOL625. Formerly: ZOOL625.
Mathematical methods of analyzing deterministic and stochastic biological processes from a variety of areas (including population and evolutionary biology, neurobiology, physiology, and morphogenesis). Qualitative aspects of dynamical systems which are usually given as difference or differential equations. The computer program Mathematica will be used to obtain the numerical solutions of these equations.

BIOL 671 Molecular Evolution (3 credits)
Credit only granted for: BIOL671 or ZOOL645. Formerly: ZOOL645.
Basic foundations through advanced concepts in molecular evolution, including patterns and processes of DNA sequence variation, transposable element dynamics, gene duplication and loss, and genome organization. Relevant concepts from genetics, biochemistry, and phylogenetics also will be covered.

BIOL 701 Teaching Biology (1 credits)
Credit only granted for: BIOL701 or ZOOL701. Formerly: ZOOL701.
Introduction to instructional methods and strategies, University and College policies, and campus resources for new LFSC graduate teaching assistants.

BIOL 704 Cell Biology from a Biophysical Perspective (3 credits)
Recommended: BSCI330, PHYS121, and PHYS122. Also offered as: BSCI404. Credit only granted for: BSCI404, BIOL704, BIOL708O, or BIPH704. Formerly: BIOL708O.
An approach to cell biology by focusing on mechanisms and unifying paradigms. It will not assume a great deal of factual

biological knowledge, but will expect a background that prepares students to think quantitatively and mechanistically.

BIOL 708 Advanced Topics in Biology (1-4 credits)
Repeatable to 8 credits if content differs. Credit only granted for: BIOL708 or ZOOL708. Formerly: ZOOL708.
Lectures, experimental courses and other special instructions in various zoological subjects.

BIOL 709 Selected Advanced Topics in Biology (1-4 credits)
Repeatable to 16 credits.
Lectures, experimental courses and other special instructions in various biological subjects.

BIOL 710 Plant Ecological Genetics (3 credits)
Prerequisite: BSCI472 and BSCI222; or permission of instructor. Credit only granted for: BIOL710 or PBIO745. Formerly: PBIO745.
Plant ecological genetics is focused on the processes responsible for evolution in plant populations. Covers the basic principle of population genetics, then quickly shifts towards understanding how allele frequencies can change in an ecological context. Emphasis is placed on the role of drift and selection in evolution, and particular attention is placed on plant mating system evolution.

BIOL 744 Neurophysiology (3 credits)
Prerequisite: PHYS122.
The physiology of nerves, muscles, an sensory receptors, and aspects of central nervous system physiology.

BIOL 760 Plant Population Biology (3 credits)
Prerequisite: BSCI472; or permission of instructor. Credit only granted for: BIOL760 or PBIO740. Formerly: PBIO740.
An examination of current theoretical and empirical research covering topics such as demography, reproductive strategy, clonality, seed banks,interspecific competition and plant-herbivore interactions.

BIOL 762 Physiological Plant Ecology (2 credits)
Prerequisite: BSCI460; or students who have taken courses with comparable content may contact the department. Credit only granted for: BIOL762 or PBIO755. Formerly: PBIO755.
Environmental effects on plant ecophysiology. Microclimatology, leaf energy balance, plant responses to temperature and radiation, physiological adaptations, water relations and plant gas exchange.

BIOL 765 Sociobiology (4 credits)
Prerequisite: Must have completed a course in behavior. Restriction: Permission of instructor. Credit only granted for: BIOL765 or ZOOL665. Formerly: ZOOL665.
Deals with the description and analysis of animal social organizations the adaptive nature of animal societies, the effects of early experience, and the role of communication in the integration of animal groups.

BIOL 767 Behavioral Endocrinology (3 credits)
Prerequisite: BSCI342 or BSCI447. Credit only granted for: BIOL767 or ZOOL627. Formerly: ZOOL627.
The interactive effects of hormones and behavior. Emphasis on the reproductive and stress hormones as they affect the brain and behavior.

BIOL 799 Master's Thesis Research (1-6 credits)
Formerly: ZOOL799.

BIOL 898 Pre-Candidacy Research (1-8 credits)

BIOL 899 Doctoral Dissertation Research (1-8 credits)
Formerly: ZOOL899.

Biometrics (BIOM)

BIOM 405 Computer Applications in Biometrics (1 credits)
An introduction to computer applications for data analysis. This is equivalent to the computer lab of 601 and is required for students that have taken BIOM 301 and BIOM402 and wish to go directly into BIOM602.

BIOM 601 Biostatistics I (4 credits)
Prerequisite: BIOM301 or STAT464; or students who have taken courses with comparable content may contact the department. Credit only granted for: BIOM401 or BIOM601.
Estimation and hypothesis testing, t tests, one and two way analysis of variance, regression, analysis of frequency data. Lecture will emphasize uses and limitations of these methods in biology, while the laboratory will emphasize the use of statistical analysis software for the analysis of biological data.

BIOM 602 Biostatistics II (4 credits)
Prerequisite: BIOM601 or BIOM405.
The principles of experimental design and analysis of variance and covariance.

BIOM 603 Biostatistics III (4 credits)
Prerequisite: Must have completed a graduate-level statistical class; or students who have taken courses with comparable content may contact the department.
Applications and implementation of linear model analysis to biological data, including multivariate regression model, mixed model, generalized linear mixed model, nonlinear logistic and Poisson regression models, power calculation and survival analysis.

BIOM 621 Applied Multivariate Statistics (3 credits)
Prerequisite: BIOM602.
Recommended: BIOM603.
Brief review of matrix algebra, means, covariance matrices, multivariate normal, multivariate confidence ellipses, MANOVA, Discriminant Methods, Principal Component Analysis, Factor Analysis, Multidimensional Scaling, Cluster Analyses, and other topics, depending on student interest.

BIOM 688 Topics in Biometrics (1-3 credits)
Restriction: Permission of AGNR-Animal & Avian Sciences department. Repeatable to 6 credits if content differs.
Advanced topics of current interest in various areas of biometrics. Credit assigned will depend on lecture and/or laboratory time scheduled and organization of the course.

BIOM 698 Special Problems in Biometrics (1-3 credits)
Restriction: Permission of AGNR-Animal & Avian Sciences department; and permission of instructor. Repeatable to 6 credits if content differs.
Individual study of a particular topic in biostatistics or biomathematics.

BIOM 699 Seminar in Biometrics (1 credits)

Biophysics (BIPH)

BIPH 698 Biophysics Seminar (1 credits)

BIPH 699 Research in Biophysics (2 credits)
Restriction: Must be in one of the following programs (Biophysics (Master's); Biophysics (Doctoral)). Repeatable to 8 credits if content differs.
Supervised research in biophysics laboratories. Rotations through several laboratories prior to a choice of laboratory for a research assistantship.

BIPH 704 Cell Biology from a Biophysical Perspective (3 credits)
Recommended: BSCI330, PHYS121, and PHYS122. Also offered as: BSCI404, BIOL704. Credit only granted for: BSCI404, BIOL704, BIOL708O, or BIPH704.
An approach to cell biology by focusing on mechanisms and unifying paradigms. It will not assume a great deal of factual biological knowledge, but will expect a background that prepares students to think quantitatively and mechanistically.

BIPH 799 Master's Thesis Research (1-6 credits)

BIPH 898 Pre-Candidacy Research (1-8 credits)

BIPH 899 Doctoral Dissertation Research (1-8 credits)

Biological Sciences (BISI)

BISI 799 Master's Thesis Research (1-6 credits)
Repeatable to 99 credits.

BISI 898 Pre-Candidacy Research (1-8 credits)

BISI 899 Doctoral Dissertation Research (1-8 credits)

Business and Management (BMGT)

BMGT 402 Database Systems (3 credits)
Recommended: BMGT302.
The fundamentals of database management systems (DBMS), data models, query processing, and data warehouses, and their application in the development of business information systems will be covered. An important goal of this course is to understand the value of information resources and information management challenges within an organization.

BMGT 403 Systems Analysis and Design (3 credits)
Prerequisite: BMGT301; or students who have taken courses with comparable content may contact the department. Recommended: BMGT302.
Techniques and tools applicable to the analysis and design of computer-based information systems. System life cycle, requirements analysis, logical design of databases and performance evaluation. Emphasis on case studies. Project required that involves the design, analysis and implementation of an information system.

BMGT 404 Developing Applications for Decision Analytics (3 credits)
Recommended: BMGT302.
Focuses on developing skills relevant to the design and development of interactive business analytics applications. Students will learn to use Excel and Visual Basic for Applications (VBA) to develop applications for business production planning, resource allocation, budgeting, finance, and marketing, among others.

BMGT 405 Data Communications and Networking (3 credits)
Prerequisite: BMGT301; or students who have taken courses with comparable content may contact the department.
Concepts of business data communications and data processing. Application of these ideas in computer networks, including basic principles of telecommunications technology, computer network technology, data management in distributed database systems and management of the technical and functional components of telecommunications technology.

BMGT 406 Developing Applications for the Web and Social Media (3 credits)
Prerequisite: BMGT402 and BMGT302. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.
The design and development of Web applications and the underlying platforms and standards for Web application development will be covered. It will examine the phenomenon of social media, social networking and crowdsourcing and understand their use within organizations.

BMGT 407 Information Systems Projects (3 credits)
Prerequisite: BMGT402 and BMGT403. Restriction: Senior standing.
Senior capstone course for the decision and information sciences major. Collected knowledge from the DIS courses and application to significant problems of size and complexity. State-of-the-art research ideas and current business and industrial practices in information systems.

BMGT 408 Emerging Topics in Information Systems (3 credits)
Restriction: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits if content differs.
Selected advanced topics covering emerging developments in the field of decision and information technologies.

BMGT 410 Government Accounting (3 credits)
Prerequisite: BMGT221.
An introduction to the theory and practice of accounting and financial reporting as applied in both federal and state/local governments, with a focus on generally accepted accounting principles applicable in each. Topics include analyzing transactions; recognizing transactions in the accounting cycles; and preparing and analyzing financial statements and the overall financial reports at both the federal and state/local government levels.

BMGT 411 Ethics and Professionalism in Accounting (3 credits)
Prerequisite: BMGT311. Restriction: Must be in Accounting program.
Analysis and discussion of issues relating to ethics and professionalism in accounting.

BMGT 417 Taxation of Corporations, Partnerships and Estates (3 credits)
Prerequisite: BMGT221.
Federal taxation of corporations using the life-cycle approach-formation, operation, assessment, merger, reorganization and liquidation. Overviews of pass-through entities - partnerships and s-corporations - using the life-cycle approach, and the tax consequences of wealth transfers by individuals - gift and estate taxation. Both tax planning and compliance issues are addressed.

BMGT 422 Auditing Theory and Practice (3 credits)
Prerequisite: BMGT310; and must have completed or be concurrently enrolled in BMGT311.
A study of the independent accountant's attest function, generally accepted auditing standards, compliance and substantive tests and report forms and opinions.

BMGT 423 Fraud Examination (3 credits)
Prerequisite: BMGT310.
Covers fraud prevention, detection and investigation techniques. The traditional accounting areas of fraud-fraudulent financial accounting and misappropriation of assets as well as recent and historical cases of fraud will also be examined. Current fraud topics will be discussed.

BMGT 424 Advanced Accounting (3 credits)
Prerequisite: BMGT311.
Advanced accounting theory applied to specialized topics and current problems. Emphasis on consolidated statements and partnership accounting.

BMGT 426 Advanced Managerial Accounting (3 credits)
Prerequisite: BMGT321.
Advanced cost accounting with emphasis on managerial aspects of internal record-keeping and control systems.

BMGT 428 Special Topics in Accounting (3 credits)
Prerequisite: BMGT310. Restriction: Must be in Accounting program. Repeatable to 9 credits if content differs.
Selected advanced topics in Accounting.

BMGT 430 Linear Statistical Models in Business (3 credits)
Prerequisite: BMGT231 or BMGT230; or permission of BMGT-Robert H. Smith School of Business.
Model building involving an intensive study of the general linear stochastic model and the applications of this model to business problems. The model is derived in matrix form and this form is used to analyze both the regression and ANOVA formulations of the general linear model.

BMGT 431 Data Analytics (3 credits)
Prerequisite: BMGT430.
An introduction to the tools and techniques that are central to the analysis of abundant data that is being collected in many forms including web traffic, social network data, and reviews and comments on websites.

BMGT 434 Introduction to Optimization (3 credits)
Prerequisite: MATH220 or MATH140; or students who have taken courses with comparable content may contact the department. Recommended: MATH221; or MATH141. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.
Introduces concepts and techniques of operations research to model and solve business decision problems, focusing on optimization and commercially available software tools. Models include linear programming, the transportation and assignment problems, network flow models, and non-linear programming. Emphasis is placed on analyzing business scenarios and formulating associated decision models.

BMGT 435 Business Process Simulation (3 credits)
Prerequisite: BMGT231 or BMGT230; or students who have taken courses with comparable content may contact the department. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.
Develop and plan simulation studies, build simulation models with special purpose software, analyze and interpret the results. Extensive use of applications and real-world examples. The emphasis is on model formulation and the interpretation of results, rather than mathematical theory.

BMGT 438 Special Topics in Operations Management (1-3 credits)
Repeatable to 6 credits if content differs.
Selected advanced topics in operations management.

BMGT 440 Advanced Financial Management (3 credits)
Prerequisite: BMGT340.
Analysis and discussion of cases and readings relating to financial decisions of the firm. The application of finance concepts to the solution of financial problems is emphasized.

BMGT 441 Fixed Income (3 credits)
Prerequisite: BMGT340. Credit only granted for: BMGT448A or BMGT441. Formerly: BMGT448A.
Describes important financial instruments which have market values that are sensitive to interest rate movements. Develops tools to analyze interest rate sensitivity and value fixed income securities. Defines and explains the vocabulary of the bond management business.

BMGT 442 Advanced Portfolio Management (3 credits)
Prerequisite: BMGT343. Credit only granted for: BMGT442 or BMGT448C. Formerly: BMGT448C.
An in-depth coverage of statistical methods for choosing stocks is provided. Financial markets data is used in the class. Students are also expected to learn and use Matlab during the class to implement the concepts of the class.

BMGT 443 Applied Equity Analysis and Portfolio Management (3 credits)
Prerequisite: BMGT343.
Study and application of the concepts, methods, models, and empirical findings to the analysis, valuation and selection of securities, especially common stock.

BMGT 444 Futures and Options Contracts (3 credits)
Prerequisite: BMGT343. Credit only granted for: BMGT444 and MATH424.
The institutional features and economic rationale underlying markets in futures and options. Hedging, speculation, structure of futures prices, interest rate futures, efficiency in futures markets and stock and commodity options.

BMGT 445 Banking and Financial Institutions (3 credits)
Prerequisite: BMGT340. Recommended: ECON330 or BMGT341.
Analysis and discussion of cases and readings in commercial bank management. The loan function is emphasized; also the management of liquidity reserves, investments for income and source of funds. Bank objectives, functions, policies, organization, structure, services and regulation are considered.

BMGT 446 International Finance (3 credits)
Prerequisite: BMGT340.
Financial management from the perspective of the multinational corporation. Topics covered include the organization and functions of foreign exchange and international capital markets, international capital budgeting, financing foreign trade and designing a global financing strategy. Emphasis of the course is on how to manage exchange and political risks while maximizing benefits from global opportunity sets faced by the firm.

BMGT 447 Computational Finance (3 credits)
Prerequisite: BMGT343. Credit only granted for: BMGT447 or BMGT448E. Formerly: BMGT448E.
Students will be introduced to tools for solving financial problems, specifically Excel functions and techniques, Visual Basic (VBA) Programming and Monte Carlo method & variations. Students will then apply these tools to solve problems related to options valuation, portfolio management, and risk management.

BMGT 448 Special Topics in Finance (1-3 credits)
Repeatable to 9 credits if content differs.
Selected advanced topics in finance.

BMGT 449 Investment Fund Management: Lemma Senbet Fund (3 credits)
Prerequisite: BMGT343. Corequisite: BMGT443. Restriction: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 6 credits if content differs.
The Lemma Senbet Fund is a year-long, advanced finance course available to undergraduate finance majors in their senior year. Ten to twelve students will be selected in the spring of their junior year to participate on the fund, two as portfolio managers and eight to ten as equity analysts. The course provides students with the opportunity to apply what they have learned in finance classes to actual investment decisions, through researching real companies and managing a portfolio of real money.

BMGT 450 Integrated Marketing Communications (3 credits)

Prerequisite: BMGT350. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT354 or BMGT450. Formerly: BMGT354.
In-depth study of coordinated marketing activities including advertising, sales promotion, Internet marketing, direct marketing and personal selling. Emphasizes strategic planning to effectively use these promotional tools to communicate with customers and meet marketing goals. Blends theory and current practice to provide managerial orientation.

BMGT 451 Consumer Analysis (3 credits)
Prerequisite: BMGT350. Recommended: PSYC100; and PSYC221.
Identifying buyer behavior concepts relevant to a specific marketing problem so that appropriate marketing decisions can be made. Conceptual frameworks are drawn from psychology, sociology, economics, and other social sciences to aid in understanding the behavior of ultimate and industrial buyers.

BMGT 452 Marketing Research Methods (3 credits)
Prerequisite: BMGT350 and BMGT230.
Focuses on aiding marketing decision-making through exploratory, descriptive and casual research. Develops student skills in designing market research studies, including selection of data collection method, development of data collection instrument, sample design, collection and statistical analysis of data and reporting the results.

BMGT 454 Global Marketing (3 credits)
Prerequisite: BMGT350.
Marketing functions from the global executive's viewpoint, including coverage of global marketing policies relating to product adaptation, data collection and analysis, channels of distribution, pricing, communications and cost analysis. Consideration is given to the cultural, legal, financial and organizational aspects of global marketing.

BMGT 455 Sales Management (3 credits)
Prerequisite: BMGT350.
The roles of the sales executive as a planner, manager of resources and marketing functions and recruiter, trainer, motivator and leader of field sales personnel. Techniques and sequence of problem analysis for selling and sales management decisions and to the practical framework in which these decisions take place. Teaching vehicles feature strong classroom interactions, cases, journal articles, research findings, guest sales managers, debates, and modern company practices.

BMGT 457 Marketing Policies and Strategies (3 credits)
Prerequisite: BMGT350.
This capstone course ties together various marketing concepts using the fundamentals of strategic market planning as the framework. Application of these principles is accomplished by analyzing and discussing cases and by playing a marketing strategy computer simulation game. Analysis of current business articles to understand the link between theory and real-world problem solving.

BMGT 458 Special Topics in Marketing (1-3 credits)
Repeatable to 6 credits if content differs.
Selected advanced topics in marketing.

BMGT 461 Entrepreneurship (3 credits)
Restriction: Must not have completed BMGT361. Credit only granted for: BMGT261, BMGT361, or BMGT461.
Process of creating new ventures, including evaluating the entrepreneurial team, the opportunity and the financing requirements. Skills, concepts, mental attitudes and knowledge relevant for starting a new business.

BMGT 463 Cross-cultural Challenges in Business (3 credits)
Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.
Examines in depth the nature of international cultural value-differences and their behavioral-related effects in the workplace. Topics include decision-making and leadership styles and reactions to various work assignments and reward structures.

BMGT 464 Organizational Change (3 credits)
Prerequisite: BMGT364.
An examination of research and theory concerning the forces which contribute to the behavior of organizational members. Topics covered include work group behavior, supervisory behavior, intergroup relations, employee goals and attitudes, communication problems, organizational change and organizational goals and design.

BMGT 465 Business Plan For The New Venture (3 credits)
Prerequisite: BMGT461 or BMGT361.
Each student focuses on the production of a business plan that will be accepted for an annual business plan competition. Business plans of sufficient quality may be submitted to attract financing. Topics include a deep review of business construction and its derivative short forms.

BMGT 466 Global Business Strategy (3 credits)
Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.
Focuses on the strategic challenges that directly result from and are associated with the globalization of industries and companies. Topics include drivers of industry globalization, difference between global and multi-domestic industry, global expansion strategies, sources of competitive advantage in a global context, and coordination of a company across a global network.

BMGT 468 Special Topics in Management and Organization (1-3 credits)
Repeatable to 6 credits if content differs.
Selected advanced topics in management and organization.

BMGT 469 Management and Organization Short-term Study Abroad (3 credits)
Repeatable to 9 credits if content differs.
Selected short-term study abroad topics in management and organization.

BMGT 470 Carrier Management (3 credits)
Prerequisite: BMGT370.
The study of the wide range of issues facing managers in transportation. This includes decisions on market entry, pricing, competitive responses, service levels, marketing strategies, capital structure, and growth objectives. Specific management decisions and overall strategies pursued by management are examined.

BMGT 471 Seminar in Supply Chain Management: An Executive Perspective (3 credits)
Prerequisite: BMGT372. Formerly: BMGT488L and BMGT498L.
Designed to provide students intensive interaction with senior supply chain executives from a cross-section of industries. Executives will share their insights about leading competitive supply chains in the global marketplace and assist students in understanding how to develop supply chain career strategies. Students will research the competitive supply chain dynamics of each executive's industry and review/analyze their findings with the executive.

BMGT 472 Purchasing and Inbound Logistics (3 credits)
Prerequisite: BMGT372.
Analysis of the resupply activities of logistics management, including purchasing policies, transportation planning, and inventory control. Attention

is directed toward total cost minimization and the establishment of a sustainable competitive advantage based on procurement.

BMGT 475 Supply Chain Strategy and Network Design (3 credits)

Prerequisite: BMGT372.

Analysis of the strategic aspects of supply chain management. Emphasis on the creation of end-user value through supply chain cost reductions, service improvements or both. Attention is directed toward the enabling role of technology in support of strategy evaluation and implementation.

BMGT 476 Technology Applications in Supply Chain Management (3 credits)

Prerequisite: BMGT372.

An understanding of the role of technology in managing the supply chain. Provides students with hands-on experience in advanced software systems that build on top of enterprise resource planning systems. Major emphasis is placed on demonstrating that these systems result in supply chain cost reductions and service improvements.

BMGT 477 International Supply Chain Management (3 credits)

The study of the importance of the supply chain management within a global context. Topics covered include: the structure, service, pricing and competitive relationships among international carriers and transport intermediaries as well as documentation, location decisions, international sourcing/distribution and management of inventory throughout the international supply chain.

BMGT 478 Special Topics in Supply Chain Management (3 credits)

Repeatable to 9 credits if content differs. Additional information: Course prerequisites will vary depending on the topic. A maximum of 3 credits of BMGT478 course work can fulfill Supply Chain Management major requirements.

Selected advanced topics in supply chain management.

BMGT 482 Business and Government (3 credits)

Prerequisite: ECON200.

Focus is on the complex interrelationships between business and government. Explores areas in which business and government are allies (cooperative research and financing program) and adversaries (regulation). Emphasizes a strategic management approach by business to government involvement in economic affairs.

BMGT 484 Electronic Marketing (3 credits)

Prerequisite: BMGT350. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.

Examines the process of developing, implementing and analyzing strategies for successfully marketing a variety of existing and potential products and services on the Internet. Special attention devoted to the tools and techniques unique to the electronic media.

BMGT 485 Project Management (3 credits)

Prerequisite: BMGT231 or BMGT230; or students who have taken courses with comparable content may contact the department. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.

Modern project management techniques that are used by modern practicing professionals will be covered. Particular attention is given to the management of technology based systems and projects in a business enterprise. The topics covered include: defining project scope, alignment of projects with enterprise strategy, managing project cost, time and risks using tools such as CPM/PERT, and measuring project performance.

BMGT 486 Total Quality Management (3 credits)

Prerequisite: BMGT230; or students who have taken courses with comparable content may contact the department.

Total Quality Management and the synergy required between functions to obtain the customer's quality demands. Statistical tools which are mandatory in any successful quality effort.

BMGT 487 Six Sigma Innovation (3 credits)

Prerequisite: STAT400, BMGT231, BMGT230, or ENME392.

Enhances the overall understanding of Six Sigma Strategy, Tools and Methods to positively influence the performance of a business process, a product or service. Highlights the application of Define-Measure-Analyze-Improve-Control (DMAIC),Design For Six Sigma (DFSS), and the pursuit of Critical to Quality criteria (CTQ's) in a collaborative perspective, one that recognizes a balance between efficiency, and effectiveness and between statistical analysis and statistical thinking.

BMGT 488 Special Topics in Logistics, Business, and Public Policy (1-3 credits)

Repeatable to 6 credits if content differs.

Selected advanced topics in logistics, business and public policy.

BMGT 490 Quest Consulting and Innovation Practicum (4 credits)

Prerequisite: ENES390 or BMGT390. Also offered as: ENES490. Credit only granted for: BMGT490 or ENES490.

Final course in the QUEST Honors Fellows Program three-course curriculum. Based on a team-based consulting project with one of QUEST's professional partners. A project advisor and professional champion supervise each student team. Requires extensive out-of-class work.

BMGT 491 Defining Consulting and Innovation Projects (3 credits)

Prerequisite: BMGT190 or ENES190. Restriction: Restricted to QUEST Program (TQMP) students. Also offered as: ENES491. Credit only granted for: BMGT491, ENES491 or BMGT438D. Formerly: BMGT438D.

Cultivate relationships with new and current corporate partners and prepare project scopes for QUEST's capstone course, BMGT/ENES 490H. Requires independent work communicating with clients and class visits to a variety of potential project sites.

BMGT 493 Honors Study (3 credits)

Restriction: Permission of BMGT-Robert H. Smith School of Business.

First semester of the senior year. The course is designed for honors students who have elected to conduct intensive study (independent or group). The student will work under the direct guidance of a faculty advisor and the Assistant Dean of Undergraduate Studies. They shall determine that the area of study is of a scope and intensity deserving of a candidate's attention. Formal written and/or oral reports on the study may be required by the faculty advisor.

BMGT 494 Honors Study (3 credits)

Prerequisite: BMGT493. Restriction: Permission of BMGT-Robert H. Smith School of Business; and must be in the Smith School Honors Fellows program.

Second semester of the senior year. The student shall continue and complete the research initiated in BMGT 493, additional reports may be required at the discretion of the faculty advisor and Assistant Dean of Undergraduate Studies.

BMGT 495 Strategic Management (3 credits)

Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.

A case-based course where students learn to play the role of the "strategic manager" who defines the scope of its business operations and, within the chosen scope, how the firm will compete against rivals. This course focuses on how a firm can both formulate effective

business-level and corporate-level strategies to achieve competitive advantage and earn above average profits.

BMGT 496 Business Ethics and Society (3 credits)
Prerequisite: 1 course in BMGT; or permission of BMGT-Robert H. Smith School of Business.
A study of the standards of business conduct, morals and values as well as the role of business in society with consideration of the sometimes conflicting interests of and claims on the firm and its objectives. Emphasizes a strategic approach by business to the management of its external environment.

BMGT 497 Strategic Management for Non Business Majors (2 credits)
Restriction: Must be admitted to the Minor in General Business or the Minor in Innovation and Entrepreneurship; and must not be a major in the R.H. Smith School of Business. Additional information: Course does not apply toward a Smith School degree.
Focuses on how a firm can both formulate and implement effective business-level and corporate-level strategies to achieve competitive advantage and earn above average profits

BMGT 498 Special Topics in Business and Management (3 credits)
Restriction: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 6 credits if content differs.
Special topics in business and management designed to meet the changing needs and interests of students and faculty.

BMGT 499 Advanced Business Topics (1 credits)
Restriction: Must be in a major in BMGT-Robert H. Smith School of Business. Repeatable to 3 credits if content differs.
Course will delve deeply into a specific business topic. Based on experience and knowledge from undergraduate core business classes, students will examine a particular subject from various angles.

BMGT 703 ICT Supply Chain Risk Management (3 credits)
Credit only granted for: BULM744 or BMGT703.
Explores methods to build ICT Supply Chain Risk Management (SCRM) capability from multiple perspectives: -From the perspective of the cyber supply chain planner who has to assess strategic & operational ICT risks on a system-wide basis. -From the perspective of the cyber supply chain operations director who must help ensure that enterprise ICT systems adapt to day-to-day uncertainties. -From the perspective of cyber supply chain customers who are concerned about how to ensure day to day business continuity of ICT systems and also cope with low probability but high impact events such as a cyber-terrorist event.

BMGT 704 Information Technology Acquisition in the Federal Government (3 credits)
Credit only granted for: PUAF689F or BMGT704.
Provides an overview of acquisition as one of the basic functions of government, all aspects of federal government contracting, subcontracting and related challenges, from the development of solicitation to final close-out, within the context of the federal laws and the Federal Acquisition Regulations (FAR), and explore ways to improve (from a public policy perspective) the efficiency and effectiveness with which the government goes about acquiring well over $300 Billion of goods and services.

BMGT 705 Cybersecurity Technology (3 credits)
Credit only granted for: ENRE684 or BMGT705.
Discuss the main concepts of Cybersecurity, how to manage Cybersecurity, the main security models and how to evaluate Cybersecurity. The course will also review how security is implemented in operating systems (Unix and Windows), databases, software, networks, web, and mobile devices.

BMGT 706 Capstone - Cybersecurity Leadership (3 credits)
Builds on the background from other foundational courses in the Professional Studies Certificate in Cybersecurity Leadership program and utilizes team-based consulting projects to provide students with a methodology and hands-on experiment for diagnosing and solving real world Cybersecurity assurance problems.

BMGT 708 Special Topics in Cybersecurity (3 credits)
Repeatable to 9 credits if content differs.
Special Topics in Cybersecurity

BMGT 788 Mastery Topic for EMBA (2 credits)
Restriction: Must be in Executive MBA program. Repeatable to 8 credits if content differs.
Selected mastery topics which will cover various aspects of executive education.

BMGT 789 Action Learning Project (3-4 credits)
Restriction: Must be in Executive MBA program. Repeatable to 10 credits if content differs.
Significant consulting project, team designed by individual EMBA student participants and faculty.

BMGT 808 Special Topics in Information Systems (1-9 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 18 credits if content differs.
Special topics specific to the Information Systems doctoral field of study.

BMGT 811 Seminar in Financial Accounting (3 credits)
Seminar in selected classic and current theoretical and empirical research in financial accounting.

BMGT 814 Current Problems of Professional Practice (3 credits)
Generally accepted auditing standards, auditing practices, legal and ethical responsibilities, and the accounting and reporting requirements of the securities and exchange commission.

BMGT 815 Analytic Modeling in Accounting (3 credits)
Prerequisite: ECON603; or students who have taken courses with comparable content may contact the department.
Seminar in formal analytical modeling in accounting research.

BMGT 818 Special Topics in Accounting and Information Assurance (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Accounting and Information Assurance doctoral field of study.

BMGT 820 Research Methods (3 credits)
Restriction: Must be in Business and Management (Doctoral) program; or permission of instructor.
The purpose of this course is to introduce doctoral students to the philosophy of science and methods for conducting business research. This course is appropriate for all doctoral students who want to develop a basic understanding of these fundamental business research techniques and when it is appropriate to use them.

BMGT 821 Seminar in Management Accounting (3 credits)
Design and use of accounting information systems for managerial planning and controllership.

BMGT 828 Independent Study in Business and Management (1-9 credits)

BMGT 830 Operations Research: Linear Programming (3 credits)
Prerequisite: MATH240; or students who have taken courses with comparable content may contact the department; or permission of BMGT-Robert H. Smith School of Business.
Concepts and applications of linear programming models, theoretical development of the simplex algorithm, and primal-dual problems and theory.

BMGT 831 Operations Research: Extension of Linear Programming and Network Analysis (3 credits)
Prerequisite: BMGT830; or students who have taken courses with comparable content may contact the department; or permission of BMGT-Robert H. Smith School of Business.
Concepts and applications of network and graph theory in linear and combinatorial models with emphasis on computational algorithms.

BMGT 832 Operations Research: Optimization and Nonlinear Programming (3 credits)
Prerequisite: BMGT830; and (MATH241; or students who have taken courses with comparable content may contact the department). Or permission of BMGT-Robert H. Smith School of Business.
Theory and applications of algorithmic approaches to solving unconstrained and constrained non-linear optimization problems. The Kuhn Tucker conditions, Lagrangian and Duality Theory, types of convexity, and convergence criteria. Feasible direction procedures, penalty and barrier techniques, and cutting plane procedures.

BMGT 833 Operations Research: Integer Programming (3 credits)
Prerequisite: BMGT830; and (MATH241; or students who have taken courses with comparable content may contact the department). Or permission of BMGT-Robert H. Smith School of Business.
Theory, applications, and computational methods of integer optimization. Zero-one implicit enumeration, branch and bound methods, and cutting plane methods.

BMGT 834 Operations Research: Probabilistic Models (3 credits)
Prerequisite: MATH241; and (STAT400; or students who have taken courses with comparable content may contact the department). Or permission of BMGT-Robert H. Smith School of Business.
Theoretical foundations for the construction, optimization, and applications of probabilistic models. Queuing theory, inventory theory, Markov processes, renewal theory, and stochastic linear programming.

BMGT 835 Simulation of Discrete-Event Systems (3 credits)
Prerequisite: Knowledge of Fortran, Basic, C, or Pascal.
Simulation modeling and analysis of stochastic discrete-event systems such as manufacturing systems, inventory control systems, and computer/ communications networks.

BMGT 836 Applied Regression Models (3 credits)
Recommended: It is assumed that the student has taken a first course in statistics and is familiar with the content of such course including interval estimation and hypothesis testing.
An introduction to regression models used in business research. Topics include: simple and multiple regression, diagnostics for checking model adequacy, transformations, polynomial models, indicator variables, multicollinearity, variable selection, times series data, generalized linear models, implementation using statistical software, and application to research questions.

BMGT 837 Applied Multivariate Analysis (3 credits)
Recommended: BMGT836 or equivalent course. BMGT837 assumes working knowledge of matrices and elementary linear algebra and a sound understanding of univariate statistics, including random variables, statistical inference, ANOVA, and ordinary least squares regression.
Multivariate statistical methods and their use in empirical research. Topics include: summarization and visualization of multivariate data, the multivariate normal distribution, tests on mean vectors, multivariate paired comparisons, multivariate analysis of variance, repeated measures designs, test on covariance matrices, discriminant analysis and classification, canonical correlation, principal components, factor analysis and cluster analysis. Maximum likelihood estimation and the likelihood ratio method of test construction.

BMGT 838 Special Topics in Operations Management/Management Science (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Operations Management/Management Science doctoral field of study.

BMGT 840 Seminar in Financial Theory (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business.
Seminar in selected classic and current theoretical and empirical research in the foundations of finance.

BMGT 841 Seminar in Corporate Finance (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business.
Seminar in selected classic and current theoretical and empirical research in corporate finance.

BMGT 843 Seminar in Portfolio Theory (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business.
Seminar in selected classic and current theoretical and empirical research in portfolio theory.

BMGT 845 Interaction of Finance and Industrial Organization (3 credits)
Prerequisite: BMGT840.
Recommended: BMGT841. Credit only granted for: BMGT808C or BMGT845. Formerly: BMGT808C.
The primary topics of the course concern the interaction between the firm's real decisions and its financial decisions in different equilibrium industrial organization settings. This course will involve a fair amount of microeconomics and industrial organization in addition to finance. Both theoretical articles and empirical articles will be covered and discussed. We will emphasize the link between theoretical and empirical research in both industrial organization and corporate finance.

BMGT 848 Special Topics in Finance (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Finance doctoral field of study.

BMGT 858 Special Topics in Marketing (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Marketing doctoral field of study.

BMGT 860 Seminar in Human Resource Planning and Selection (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business.
Seminar in selected theoretical and empirical literature in human resource planning, forecasting, and staffing.

BMGT 861 Seminar in Performance Appraisal and Training (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business.
Seminar in selected theoretical and empirical literature in performance appraisal and training.

BMGT 863 Work Morale and Motivation (3 credits)
Seminar on major theories of work motivation and job satisfaction.

BMGT 864 Seminar in Leadership (3 credits)
Review of theories and research on leadership, especially executive leadership.

BMGT 865 Seminar in Comparative Theories of Organization (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business.
Emphasis on the interdisciplinary literature on classical management, systems, and contingency theories of organization.

BMGT 866 Seminar in Group Processes, Organizational Conflict and Change (3 credits)
Review of theories and research in organizational development, group processes, group conflict and resolutions.

BMGT 868 Special Topics in Organizational Behavior/Human Resource Management (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Organizational Behavior/Human Resource Management doctoral field of study.

BMGT 872 Business Logistics (3 credits)
Concentrates on the design and application of methods for the solution of advanced physical movement problems of business firms. Provides thorough coverage of a variety of analytical techniques relevant to the solution of these problems. Where appropriate, experience will be provided in the utilization of computers to assist in managerial logistical decision-making.

BMGT 878 Special Topics in Strategic Management and Entrepreneurship (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Strategic Management and Entrepreneurship doctoral field of study.

BMGT 880 Business Research Methodology (3 credits)
Covers the nature, scope, and application of research methodology. The identification and formulation of research designs applicable to business and related fields. Required of D.B.A. students.

BMGT 881 Applied Regression Models (3 credits)
An introduction to regression models used in business research. Linear models, nonparametric methods, spatio-temporal models, methods for functional data, choice models, and methods for hierarchical, clustered and networked data. Hands-on learning via discussion of scholarly business papers, implementation using advanced statistical software, and application to research questions.

BMGT 882 Applied Multivariate Analysis I (3 credits)
Prerequisite: ECON624, ECON621, and EDMS651; or permission of BMGT-Robert H. Smith School of Business.
Multivariate statistical methods and their use in empirical research. Topics include summarization and visualization of multivariate data, principal components, metric multidimensional scaling, canonical correlation, multivariate paired comparisons and repeated-measures designs, multivariate analysis of variance, and discriminant analysis. The maximum likelihood and likelihood ratio principles are also discussed. An important component of the course is analysis of business data using contemporary software.

BMGT 883 Scientific Data-Collection for Business (3 credits)
Data collection methods for academic research with an emphasis on a Web environment. Designing and executing surveys, collecting web data, and designing and analyzing experiments. Discussion of ethics, statistical theory, practical considerations, and technical issues.

BMGT 887 Bayesian Inference and Decision Theory (3 credits)
Bayesian Methodologies in statistical inference and decision theory. Includes discussion of subjective probability and coherence, elicitation of distributions conjugate distributions, estimation, testing, preposterior analysis and regression analysis. Applications are drawn from the functional business areas.

BMGT 888 Special Topics in Supply Chain Management (1-9 credits)
Repeatable to 18 credits if content differs.
Special topics specific to the Supply Chain Management doctoral field of study.

BMGT 898 Pre-Candidacy Research (1-8 credits)

BMGT 899 Doctoral Dissertation Research (1-8 credits)

Biological Sciences Program (BSCI)

BSCI 401 Animal Communication (3 credits)
Prerequisite: BSCI106; and must have completed one semester of physics; and must have completed one semester of organic chemistry. Recommended: A course in animal behavior or biopsychology. Credit only granted for: BSCI401, BSCI 338W or BIOL 708W. Formerly: BSCI338W.
Examining the mechanisms by which animal produce and receive signals in each sensory modality; and quantifying the type and amount of information conveyed in signals and how animals attend to such information.

BSCI 402 Genomics of Sensory Systems (3 credits)
Prerequisite: BSCI222; or permission of instructor. Credit only granted for: BSCI338C or BSCI402. Formerly: BSCI338C.
An advanced course covering topics on the molecular basis of senses and the application of genomic techniques to studies of sensory systems & sensory ecology.

BSCI 403 Biology of Vision (3 credits)
Prerequisite: BSCI207. Recommended: BSCI222. Credit only granted for: BSCI 338V or BSCI 403. Formerly: BSCI 338V.
An upper level undergraduate course on the physical, molecular, and neural basis of vision.

BSCI 404 Cell Biology from a Biophysical Perspective (3 credits)
Prerequisite: BSCI330. Recommended: PHYS121 and PHYS122; or completion of PHYS131 and PHYS132 recommended. Also offered as: BIOL704, BIPH704. Credit only granted for: BSCI338O, BSCI404, BIOL704, BIOL708O, or BIPH704. Formerly: BSCI338O.
An approach to cell biology by focusing on mechanisms and unifying physical paradigms. It will not assume a great deal of factual biological knowledge, but will expect a background that prepares students to think mechanistically and quantitatively.

BSCI 410 Molecular Genetics (3 credits)
Prerequisite: BSCI222. And must have completed CHEM233; or (CHEM231 and CHEM232).
An advanced genetics course emphasizing the molecular basis of gene structure and function in the context of modern approaches to the genetics of humans and model organisms.

BSCI 411 Bioinformatics and Integrated Genomics (4 credits)
Prerequisite: Minimum grade of C- in BSCI222. Recommended: BSCI410. Credit only granted for: BSCI380 or BSCI411. Formerly: BSCI380.
Computational methods for the study of biological sequence data in comparative biology and evolution. Analysis of genome content and organization. Database searching, pairwise and multiple sequence alignment, phylogenetic, methods, pattern recognition, and functional inference. Functional and comparative genomics approaches.

BSCI 412 Microbial Genetics (4 credits)
Prerequisite: BSCI223 and BSCI222.
A laboratory/lecture based course that covers the fundamentals of mutation, mobile genetic elements and transmission genetics of microbial organisms using both classical and molecular approaches.

BSCI 413 Recombinant DNA (3 credits)
Prerequisite: BSCI330, BSCI223, or BSCI230; and BSCI222. Formerly: ZOOL452.
An advanced course presenting the tools and procedures of genetic engineering. Theory and practical applications of recombinant DNA techniques to understanding eukaryotic gene structure and expression.

BSCI 414 Recombinant DNA Laboratory (3 credits)
Prerequisite: BSCI222.
An advanced course offering hands-on experience in performing recombinant DNA experiments. All current molecular biology techniques used for cloning prokaryotic genes, analyzing the gene products, and modifying the genes will be performed. Techniques include isolation of DNA, use of restriction enzymes; cloning procedures, PCR analysis, and Southern hybridizations. Lecture material focuses on interpretation of results generated in the laboratory.

BSCI 415 Molecular Genetics Laboratory (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in BSCI410. Restriction: Junior standing or higher. Credit only granted for: BSCI348G or BSCI415. Formerly: BSCI348G.
Problem solving laboratory organized around extended projects that employ different approaches toward linking gene and function.

BSCI 416 Human Genetics (3 credits)
Prerequisite: Minimum grade of C- in BSCI410. Recommended: BSCI330.
Approaches to human genetics and applications to biology and medicine focusing on specific human genetic topics using primary research papers as the main resource.

BSCI 417 Microbial Pathogenesis (3 credits)
Prerequisite: BSCI223 and BSCI222. Restriction: Junior standing or higher. Credit only granted for: BSCI348M or BSCI417. Formerly: BSCI348M.
Current research in microbial pathogenesis and the molecular and cellular basis of bacterial disease. Comprehensive overview of the molecular basis of pathogenesis with a focus on model microbial systems to illustrate mechanisms of disease pathogenesis. Topics covered: how microorganisms attach to and enter cells; how host cells are damaged by microbial products; how the host responds to invasion; and host-pathogen evolution.

BSCI 420 Cell Biology Lectures (3 credits)
Prerequisite: BSCI330, BSCI222, CHEM231, and CHEM232. Credit only granted for: BSCI420 or BSCI421.
Molecular and biochemical bases of cellular organization and function in eukaryotes.

BSCI 421 Cell Biology (4 credits)
Prerequisite: BSCI330, BSCI222, CHEM231, and CHEM232. Credit only granted for: BSCI420 or BSCI421.
Molecular and biochemical basis of cellular organization and function in eukaryotes.

BSCI 422 Principles of Immunology (3 credits)
Prerequisite: BSCI223 and BSCI222. Recommended: BSCI330. Restriction: Junior standing or higher.
The immune system in health and disease. Presentation and analysis of the cellular and molecular processes that comprise the immune system.

BSCI 423 Immunology Laboratory (2 credits)
Prerequisite: BSCI223 and BSCI222. Corequisite: BSCI422. Restriction: Junior standing or higher.
Current techniques for assessment of immune status and evaluation of the immune response, including monoclonal antibody production, Western blotting, cytokine assays, ELISA and flow cytometry.

BSCI 424 Pathogenic Microbiology (4 credits)
Prerequisite: BSCI223.
The role of bacteria and fungi in the diseases of humans with emphasis upon the differentiation and culture of microorganisms, types of disease, modes of disease transmission, prophylactic, therapeutic, and epidemiological aspects.

BSCI 425 Epidemiology and Public Health (3 credits)
Prerequisite: BSCI223.
History, characteristic features of epidemiology; the important responsibilities of public health; vital statistics.

BSCI 426 Membrane Biophysics (3 credits)
Prerequisite: BSCI330; and (PHYS142, PHYS122, or PHYS132); and (MATH130 or MATH140).
Quantitative aspects of biology and the use of mathematical descriptions of biological phenomena. The focus will be on membrane structure, transport, and bioenergetics.

BSCI 427 Principles of Microscopy (2 credits)
Prerequisite: BSCI421.
An introduction to optical principles that underlie light and electron microscopic image formation. Brightfield, darkfield, phase contrast, differential interference contrast, fluorescence and polarized light microscopy. Comparison of light and electron microscopy. The application of these techniques to problems in biological research.

BSCI 430 Developmental Biology (3 credits)
Prerequisite: BSCI222 and BSCI330.
Structural, functional and regulatory events and mechanisms that operate during development to produce an integrated, multicellular organism composed of a multitude of differentiated cell types.

BSCI 433 Biology of Cancer (3 credits)
Prerequisite: BSCI222 and BSCI330; or permission of CMNS-Biological Sciences UG Program.
Causes and consequences of neoplastic transformations at the biochemical and cellular levels.

BSCI 434 Mammalian Histology (4 credits)
Prerequisite: BSCI330 and BSCI440; or permission of CMNS-Biological Sciences UG Program.
A study of the microscopic anatomy,

ultrastructure and histophysiology of tissues and organs of mammals.

BSCI 437 General Virology (3 credits)
Prerequisite: BSCI222; or permission of CMNS-Biological Sciences UG Program. Restriction: Junior standing or higher.
Discussion of the physical and chemical nature of viruses, virus cultivation and assay methods, virus replication, viral diseases with emphasis on the oncogenic viruses, viral genetics, and characteristics of the major virus groups.

BSCI 440 Mammalian Physiology (4 credits)
Prerequisite: BSCI330; and (CHEM231 and CHEM232; or must have completed CHEM233). Or permission of CMNS-Biological Sciences UG Program.
A study of the cardiovascular, hemopoietic, gastrointestinal, renal and respiratory systems. Chemical and endocrine regulation of physiological functions in mammals. Course does not count as an upper level lab for BIOL majors (see BSCI441).

BSCI 441 Mammalian Physiology Laboratory (2 credits)
Prerequisite: Must have completed or be concurrently enrolled in BSCI440.
Laboratory exercises in experimental mammalian physiology.

BSCI 442 Plant Physiology (4 credits)
Prerequisite: BSCI105. And must have completed CHEM233; or (CHEM231 and CHEM232).
A survey of the general physiological activities of plants.

BSCI 443 Microbial Physiology (3 credits)
Prerequisite: Minimum grade of C- in BSCI223. And minimum grade of C- in BCHM461; or minimum grade of C- in BCHM463.
Microbial cellular and population growth. Fermentation metabolism, physiology of anaerobiosis, and energy conservation and transformation in bacterial membranes. Efficiency of energy utilization for growth. Membrane structure and transport. Bacterial chemotaxis. Regulation of bacterial chromosome replication, RNA and protein synthesis. Control of metabolic pathways.

BSCI 446 Neural Systems (3 credits)
Prerequisite: Minimum grade of C- in BSCI330 and BSCI353.
Neural development, followed by sensory, motor and integrative system organization in the central nervous system.Sponsoring Dept. (BIOL) Specialization Areas: PHNB, GENB.

BSCI 447 General Endocrinology (3 credits)
Prerequisite: BSCI330, CHEM241, and CHEM242.
Functions and the functioning of the endocrine glands of animals with special reference to the vertebrates.

BSCI 451 Physical Chemistry for Biologists (3 credits)
Prerequisite: BSCI330.
Mechanistic and quantitative aspects of chemical and physical processes, including diffusion, ligand-receptor binding, DNA melting, sedimentation, redox reactions, kinetics, fluorescence, osmosis, and electrophoresis.

BSCI 453 Cellular Neurophysiology (3 credits)
Prerequisite: Minimum grade of C- in BSCI330, CHEM231, CHEM232, and PHYS122.
The cellular and molecular basis of nervous system function.

BSCI 454 Neurobiology Laboratory (1 credits)
Prerequisite: Minimum grade of C- in BSCI330; and must have completed or be concurrently enrolled in BSCI353; and must have completed or be concurrently enrolled in PHYS122, PHYS132, or PHYS142.
Basic neuroanatomical techniques, intracellular and extracellular recordings of electrical potentials from nerve and muscle.

BSCI 460 Plant Ecology (3 credits)
Prerequisite: BSCI106.
The dynamics of populations as affected by environmental factors with special emphasis on the structure and composition of natural plant communities, both terrestrial and aquatic.

BSCI 461 Plant Ecology Laboratory (2 credits)
Prerequisite: Must have completed or be concurrently enrolled in BSCI460.
Two or three field trips per semester. The application of field and experimental methods to the qualitative and quantitative study of vegetation and ecosystems.

BSCI 462 Population Ecology (3 credits)
Prerequisite: MATH130 and BSCI106.
Theory of population growth and regulation, life tables, and theory of competition and predation, evolution in ecological settings, community structure and dynamics.

BSCI 463 Laboratory and Field Ecology (2 credits)
Prerequisite: Must have completed or be concurrently enrolled in BSCI462; and must have completed or be concurrently enrolled in a course in statistics.
Laboratory and field exercises involving problems of contemporary ecological interest; population density regulation, community structure, and spatial pattern diversity in both terrestrial and aquatic systems.

BSCI 464 Microbial Ecology (3 credits)
Prerequisite: BSCI223 and CHEM241. And must have completed CHEM243; or CHEM242.
Interaction of microorganisms with the environment, other microorganisms and with higher organisms. Roles of microorganisms in the biosphere. Microorganisms and current environmental problems.

BSCI 465 Behavioral Ecology (3 credits)
Prerequisite: BSCI222 and BSCI106.
How natural and social environments shape individual behavior. The influence of evolution on patterns of individual adaptation. Use of the evolutionary paradigm to investigate specific problems in animal and human behavior.

BSCI 467 Freshwater Biology (4 credits)
Prerequisite: Permission of CMNS-Biological Sciences UG Program.
Biology and ecology of freshwater invertebrates in lotic and lentic habitats, their adaptation to aquatic life, their function in aquatic ecosystems, and their relationship to environmental deterioration. Laboratory will include field trips, demonstrations, and identifications.

BSCI 471 Molecular Evolution (3 credits)
Prerequisite: BSCI222; or permission of CMNS-Biology department.
Patterns of DNA sequence variation within and between species, caused by nucleotide changes and the movement of transposable elements. Theories of molecular evolution, such as the neutral theory. Molecular clock hypothesis: its importance as a practical empirical tool in molecular genetics and systematics and its theoretical foundation.

BSCI 472 Evolutionary Biology of Plants (3 credits)
Prerequisite: BSCI222 and BSCI106.
Evolution in plant populations. The pace, pattern, and mechanisms of evolution will be discussed within a genetic and ecological framework. Some emphasis will be placed on processes that are unique to the evolution of plants.

BSCI 473 Marine Ecology (3 credits)
Prerequisite: BSCI207.
Courses in evolution and animal behavior are strongly recommended. A detailed analysis of the evolutionary ecology of marine invertebrates; emphasis on testing of theories and on current literature.

BSCI 474 Mathematical Biology (4 credits)
Prerequisite: MATH220 and MATH221; or (MATH131 and MATH130).
Mathematical methods for analyzing deterministic and stochastic biological processes from a variety of areas (including population and evolutionary biology, neurobiology, physiology and morphogenesis). Qualitative aspects of dynamical systems which are usually given as difference or differential equations. The computer program Mathematica will be used to obtain the numerical solutions of these equations.

BSCI 480 Arthropod Form and Function (4 credits)
Prerequisite: Permission of CMNS-Entomology (AGNR).
Survey of the morphological, systematic and physiological diversity of the phylum Arthropoda.

BSCI 481 Insect Diversity and Classification (4 credits)
Prerequisite: BSCI337.
The techniques of collecting insects in the field and their classification into the latest hierarchical scheme. Field trips will visit habitats throughout the state. An insect collection is required.

BSCI 483 Medical and Veterinary Entomology (4 credits)
Prerequisite: Permission of CMNS-Biological Sciences UG Program.
A study of the morphology, taxonomy, biology and control of the arthropod parasites and disease vectors of man and animals. The ecology and behavior of vectors in relation to disease transmission will be emphasized.

BSCI 485 Protozoology (4 credits)
Prerequisite: Must have completed one year of biology.
Basic conceptual treatment of free-living and parasitic protozoan functional morphology, life history, and systematics. The laboratory will stress observations of protozoa, living and stained, collected from diverse habits.

BSCI 488 Summer Biology Institutes (1-8 credits)
Prerequisite: Permission of CMNS-Biological Sciences UG Program.
Repeatable to 12 credits if content differs.

BSCI 493 Medicinal and Poisonous Plants (3 credits)
Prerequisite: BSCI105; and must have completed CHEM233. Or 4 credits in BSCI courses.
A study of plants important to humans that have medicinal or poisonous properties. Emphasis on plant source, plant description, the active agent and its beneficial or detrimental physiological action and effects.

BSCI 494 Animal-Plant Interactions (3 credits)
Prerequisite: BSCI106; and permission of CMNS-Biological Sciences UG Program.
Theoretical, conceptual and applied aspects of the ecological interactions between plants and animals.

BSCI 497 Insect Pests of Ornamentals and Turf (4 credits)
The recognition, biology and management of insects and mites injurious to ornamental shrubs, trees, greenhouse crops, and turf. Emphasis on Integrated Pest Management (IPM).

Behavioral and Social Sciences (BSOS)

BSOS 438 Special Topics in Study Abroad IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

BSOS 448 Teaching Assistant Practicum (1-6 credits)
Repeatable to 9 credits.
Supervised practicum for teaching assistants for BSOS/UNIV courses.

BSOS 678 Special Topics in Justice Leadership (3 credits)
Repeatable to 18 credits if content differs.
Crime and Criminal Justice in Vietnam. Issues that will be focused on the present situation of crime in Vietnam; causes and conditions of criminal activities; include crime forecasting and crime prevention in Vietnam. Also, provides comprehensive overview on the Criminal Justice System in Vietnam and relations among authorities.

Terrorism Studies (BSST)

BSST 458 Special Topics in Study Abroad IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program

BSST 630 Motivations and Intents of Terrorists and Terrorist Groups (3 credits)
Restriction: Must be in the Terrorism Analysis Graduate Certificate Program. Credit only granted for: BSOS630 or BSST630. Formerly: BSOS630.
Examines motivations for terrorism from an interdisciplinary perspective, with emphasis on political and applied social psychological perspective. Topics may include: defining terrorism; preconditions; recruitment; domestic and international terrorism; and case studies and analysis of terrorist organizations.

BSST 631 Societal Impacts of and Responses to Terrorism (3 credits)
Restriction: Must be in Terrorism Analysis Graduate Certificate Program; or permission of department. Credit only granted for: BSOS631 or BSST631. Formerly: BSOS631.
Explores the manners in which a variety of different actors respond to both terrorist incidents and the threat of terrorism. Examines local responses to terrorist incidents; local impacts of terrorism including effects on individual and group attitudes and behaviors; policy decisions made in response to both terrorist attacks and the threat of terrorism; terrorism prevention, deterrence, interdiction, and mitigation efforts; and individual and community recovery from terrorist attacks.

BSST 632 Development of Counterterrorism Policies and Programs (3 credits)
Restriction: Must be in the Terrorism Analysis Graduate Certificate Program; or permission of department. Credit only granted for: BSOS632 or BSST632. Formerly: BSOS632.
Addresses the formulation, adoption, effectiveness, impacts, and afterlives of counterterrorism policies and programs.

BSST 633 Research Methods in Terrorism and Counterterrorism (3 credits)
Credit only granted for: BSOS633 or BSST633. Formerly: BSOS633.
Provides students with the opportunity to conduct original research, while exposing them to analytical tools relevant to the study of terrorism. Students will work with a range of data sources on domestic and international terrorism, and will be tasked with using data to test hypotheses related to the causes, behaviors, and/ or impacts of terrorism.

BSST 638 Special Topics in Terrorism Studies (3 credits)
Repeatable to 9 credits if content differs.
A special topics course for students in the Global Terrorism Minor program. Topics that may be offered are Psychology of Terrorism; Development of Counterterrorism Policies and Programs; Terrorism and Popular Culture; Terrorism and the Media; International Perspective on Terrorism and Counterterrorism (Education Abroad); The Evolution of Hezbollah; Terrorism and Small Wars; Political Islam in the West.

BSST 698 Seminar in Terrorism Studies (1-3 credits)
Repeatable to 9 credits if content differs.
A special topics seminar course for graduate students interested in terrorism studies.

BSST 699 Independent Study in Terrorism Studies (3 credits)
Repeatable to 9 credits if content differs.
An independent study course for students in the Global Terrorism Minor program.

Accounting and Information Assurance (BUAC)

BUAC 701 Accounting Theory (3 credits)
Prerequisite: BMGT310, BMGT424, and BMGT311. Credit only granted for: BMGT706 or BUAC701. Formerly: BMGT706.
Examines GAAP, its weaknesses and strengths, and the role that the FASB and SEC play in its development. Includes the FASB standard setting process and issues that relate to this process: FASB conceptual framework; lobbying activity; and impending FASB standards. Other topics include: how management incentives and firm type influence accounting choice; recognize versus disclose as a strategy; and current debates in accounting. While the user of accounting information is examined, this course focuses more on management and how it reports and discloses accounting information.

BUAC 705 Advanced Financial Reporting (3 credits)
Prerequisite: BMGT310, BMGT424, and BMGT311. Credit only granted for: BMGT707 or BUAC705. Formerly: BMGT707.
Uses authoritative professional pronuncements to examine advanced financial reporting issues. Examines complex problems in accounting and reporting; examples include penisons, taxes, interest rate swaps, derivative securities, international transactions, and international financial reporting. Takes a user-oriented perspective, and examines the ways in which financial accounting information is used by investors, analysts, and creditors. Examples include if users adjust for alternative accounting methods or for information that is recognized versus disclosed.

BUAC 710 Advanced Accounting Theory (3 credits)
Prerequisite: BUSI610. Credit only granted for: BMGT710 or BUAC710. Formerly: BMGT710.
Contemporary issues in financial accounting. The nature of income, the relationship between asset valuation and income determination, and various approaches to accounting for inflation. The accounting standards setting process. The measurement and valuation of assets (e.g., foreign investments) and liabilities (e.g., leases and pensions).

BUAC 711 Financial Planning and Control Systems for Managers and Consultants (2 credits)
Prerequisite: BUSI611, BUSI681, and BUSI630; or permission of BMGT-Robert H. Smith School of Business. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT711 and BUAC711. Formerly: BMGT711.
This course provides an analysis of several topics concerning financial planning/control systems (management accounting systems). Topics covered: design and use of cost management systems (including activity based costing systems), financial performance measures for enhancing firm value, managerial incentive contracts and accounting data, management accounting and Internet-based transactions, managing earnings and financial ratios, use of balanced scorecard to evaluate financial/nonfinancial managerial performance, management accounting systems and competitor analysis, behavioral aspects of budgeting, post-auditing of capital investments, accounting/economics aspects of information security, and transfer pricing.

BUAC 713 The Impact of Taxation on Business Decisions (3 credits)
Prerequisite: BUSI611. Credit only granted for: BMGT713 or BUAC713. Formerly: BMGT713.
The impact of tax law and regulations on alternative strategies with particular emphasis on the large, multidivisional firm. Problems of acquisitions, mergers, spinoffs, and other divestitures from the viewpoint of profit planning, cash flow, and tax deferment.

BUAC 726 Advanced Accounting Systems (3 credits)
Prerequisite: BMGT326. Credit only granted for: BMGT716 or BUAC726. Formerly: BMGT716.
A study of current information technologies and their interaction with accounting systems and the accounting profession. Topics include: systems analysis and design; databases; electronic commerce and data security; communications and image processing; and expert systems and decision support systems.

BUAC 735 Ethical and Professional Issues in Accounting (3 credits)
Prerequisite: BMGT201, BMGT422, and BMGT311. Restriction: Must not have completed BMGT411. Credit only granted for: BMGT411, BMGT714, or BUAC735. Formerly: BMGT714.
Examines the issues of professionalism and ethics in all segments of accounting. Students wishing to take this course should not take BMGT 411.

BUAC 743 Financial Statement Analysis (2 credits)
Prerequisite: BUSI610. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Provides students with the tools to conduct a financial statement analysis, which is part of an overall business analysis. This involves understanding and using the information that financial statements are communicating to users.

BUAC 750 Research and Internship in Accounting (3 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT717 or BUAC750. Formerly: BMGT717.
Completion of a research paper on an approved accounting topic. Supervised sponsored internship in an entity outside the University.

BUAC 758 Special Topics in Accounting and Information Assurance (1-3 credits)
Repeatable to 9 credits if content differs. Formerly: BMGT798.
Selected advanced topics in the various fields of graduate study in accounting and information assurance.

BUAC 759 Independent Study in Accounting and Information Assurance (1-6 credits)
Repeatable to 6 credits if content differs. Formerly: BMGT708.

Independent study for masters students in accounting and information assurance.

BUAC 765 Business Ethics for Accountants and Auditors (3 credits)

Restriction: Must be in Business and Management (Master's) program.
Considers all facets of business ethics issues within an accounting and auditing context. Ethical theory, corporate social responsibility, and individual decision-making are considered. Some of the applied topics that may be covered in this course include, but are not limited to, intellectual property issues, corporate downsizing, outsourcing, global ethics, crises management, and employment ethics.

BUAC 780 Financial Statement Analysis for Accountants and Auditors (3 credits)

Restriction: Must be in Business and Management (Master's) program.
Provides a framework for using a firm's financial statements to perform a comprehensive analysis of the firm's operating performance, cash management, and financial position as well as to value the firm and to detect earning management. It includes an overview of the accounting and auditing standard setting framework, and the relevance of U.S. GAAP as well as International Financial Reporting Standards (IFRS) to accounting recognition, measurement, presentation, and disclosure. The course also identifies the analytical relevance of a selected set of more advanced accounting topics (e.g., valuing employee stock options).

BUAC 782 Advanced Managerial Accounting and Control Systems (3 credits)

Restriction: Must be in Business and Management (Master's) program.
Focuses on topics that emphasize the role of managerial accounting in a firm's overall management planning and control structure. A key concern is to show how effective organizations ensure that the parts of the organization work together to create the whole, and how the sum of the parts, through synergy, can indeed be greater then the whole.

BUAC 784 Business Communications for Accountants and Auditors (2 credits)

Restriction: Must be in Business and Management (Master's) program.
Focuses on the art of communication and its effects on people, organizations, and other stakeholders. The course will focus on two aspects of business communications: persuasion and effective presentations. The objective for the persuasion sessions is to have students improve upon their day-to-day oral business communications skills. This will be accomplished as participants learn to tailor each communication to the person or people with whom they are speaking.

BUAC 786 Internal Auditing I: Conceptual and Institutional Framework (3 credits)

Restriction: Must be in Business and Management (Master's) program.
Provides students with an overview and basic understanding of internal auditing. Internal audit's role in internal control, risk management, business processes and risks, and Sarbanes-Oxley, Section 404 compliance efforts compliance efforts are considered. Internal auditing is presented as an integral part of effective corporate governance. Examples of assurance and consulting activities undertaken by the internal audit function, as well as the sourcing strategy (i.e., full insourcing, co-sourcing or full outsourcing models) are discussed. Students ae introduced tointernal control theory, test design concepts and internal auditing bestpractices.

BUAC 787 Internal Auditing II: Internal Audit Application and Practice (3 credits)

Prerequisite: BUAC786. Restriction: Must be in Business and Management (Master's) program.
This advanced internal auditing course contains an in-depth coverage of the internal audit process. Students receive experience in planning and conducting internal audit assurance and consulting engagements. Also, students build on the theory and techniques introduced in Internal Auditing I, through practical, in-depth coverage of specific audit areas. Other matters covered include audit evidence, workpapers, audit sampling, and communicating of engagement results. Internal auditing case studies are used to reinforce the learning process.

BUAC 788 Action Learning Project (1-2 credits)

Restriction: Must be in Business and Management (Master's) program. Repeatable to 2 credits if content differs.
A significant consulting project within teams, designed by individual MS student participants and faculty. It may also be an individual project/study or a business simulation exercise.

BUAC 790 Informtion Security, Audit and Control (3 credits)

Restriction: Must be in Business and Management (Master's) program.
Builds on basic information technology (IT) courses, focusing on key issues including IT security, IT controls, and IT auditing. Addressing issues such as auditing a computer information system; assessing risks; identifying control objectives; identifying appropriate audit procedures; learning the concepts and basic features or audit software thereby providing the tools for choosing audit software; conducting an operational audit basic controls over computer information systems; and developing world-class IT control frameworks.

BUAC 792 Forensic Accounting/Auditing (3 credits)

Restriction: Must be in Business and Management (Master's) program.
Provides a theoretical background and practical application of fraud examinations and corporate investigations. Fraud prevention, detection, investigation, and related matters such as courtroom procedures will be included. Also considered are topics such as FCPA and securities fraud. A wide variety of teaching tools are used.

Decision and Information Technologies (BUDT)

BUDT 703 Business Process Analysis for Information Systems (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT703, BMGT725, or BUDT703. Formerly: BMGT703.
Helps students gain a solid foundation in the concepts, processes, tools, and techniques needed in analyzing business processes and conducting information systems projects.

BUDT 704 Database Management Systems (2 credits)

Corequisite: BUSI620. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT704, BMGT721, or BUDT704. Formerly: BMGT704.
Introduction to the conceptual and logical design of relational database systems and their use in business environments. Topics include information modeling and optimization via normalization; Structured Query Language (SQL); Client/Server architectures; Concurrency & Recovery; Data Warehousing.

BUDT 705 Data Networks and Infrastructures (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT705, BMGT726, or BUDT705. Formerly: BMGT705.
Technical and mangerial aspects of

business data communications, networking, and telecommunications with a particular emphasis on internet-based technologies and services. Content includes history and structure of the telecommunications industry, including key legislative, regulatory and legal milestones, and management of the technical and functional components of telecommunications and data communications technology.

BUDT 706 Social Media and Web 2.0 (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Over the past years, social computing technologies such as online communities, blogs, wikis, and social networking systems have become important tools for individuals to seek information, socialize with others, get support, collaborate on work, and express themselves. Increasingly, businesses are trying to leverage web 2.0 by using social computing technologies to communicate with customers, employees, and other business partners or to build new business models. This course will review concepts and principles related to web 2.0 and examine issues and strategies associated with business use of social computing technologies.

BUDT 710 Information Technology and Organizational Transformation (2 credits)

Prerequisite: BUSI622 or BUSI621. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT720 or BUDT710. Formerly: BMGT720.

Focuses on understanding (a) the nature of new and exciting emerging technologies, (b) their value propositions for specific organizations, and (c) how these technologies will shape value creation, value capture and competition in the future. Topics include Social Computing, Telecom applications in Wireless, LBS and 3G Telephony, Outsourcing/Off-shoring, Open Source Software, Intelligent Devices and Applications, Privacy/Ethics and Managing IT Innovation.

BUDT 713 Security and Control of Information Systems (3 credits)

Prerequisite: BUSI620. Credit only granted for: BMGT727 or BUDT713. Formerly: BMGT727.

The information control risks faced by corporations. Techniques for enhancing the security and integrity of corporate information resources. The auditing and control procedures for corporate information systems. Actual case studies.

BUDT 732 Decision Analytics (2 credits)

Prerequisite: BUSI630. Credit only granted for: BMGT732 or BUDT732. Formerly: BMGT732.

Analytical modeling for managerial decisions using a spreadsheet environment. Includes linear and nonlinear optimization models, decision making under uncertainty and simulation models.

BUDT 733 Data Mining and Predictive Analytics (2 credits)

Prerequisite: BUSI630. Credit only granted for: BMGT733 or BUDT733. Formerly: BMGT733.

Data mining techniques and their use in business decision making. A hands-on course that provides an understanding of the key methods of data visualization, exploration, classification, prediction, time series forecasting, and clustering.

BUDT 750 Game Theory for Managerial Decisions (3 credits)

Prerequisite: BUSI690.

A study of managerial decision-making in strategic (or interactive) situations characterized by both conflict and cooperation. Introduces basic tools of game theory including simultaneous and sequential-move games, equilibrium analysis, repeated interactions, information assymetry, and principal-agent models. Applications of game theory to managerial decisions such as pricing, promotions, entry/exit decisions, deterrence, design of incentive contracts, supply chain relationships, auctions.

BUDT 758 Special Topics in Decision, Operations and Information Technologies (1-4 credits)

Restriction: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits if content differs. Formerly: BMGT798.

Selected advanced topics in the various fields of graduate study in decision, operations and information technologies.

BUDT 759 Independent Study in Decision and Information Technologies (1-6 credits)

Repeatable to 6 credits if content differs. Formerly: BMGT708.

Independent study for masters students in decision and information technologies.

BUDT 775 Pricing and Revenue Management (2 credits)

Prerequisite: BUSI630. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUDT758D or BUDT775. Formerly: BUDT758D.

Specialized course on pricing and revenue management (PRM) that provides students with tools and principles, drawn from several disciplines (Operations, Microeconomics, Decision Modeling, Statistics, Marketing, IS) to make effective pricing decisions. Topics covered include economics of pricing, strategy and tactics of PRM, pricing optimization, differentiated pricing, dynamic pricing, mark-down pricing, legal and ethical issues in models/methods used in making effective PRM decisions and managerial or organizational factors that hold the key to success in execution of PRM.

Finance (BUFN)

BUFN 700 Investment Management (3 credits)

Corequisite: BUSI640. Credit only granted for: BMGT743 or BUFN700. Formerly: BMGT743.

Methods of security selection and portfolio management in the debt and equity markets. Investment alternatives, securities markets, bond and common stock valuation, options, portfolio theory, and behavior of stock prices.

BUFN 702 Applied Equity Analysis and Portfolio Management (3 credits)

Prerequisite: BUSI640. Credit only granted for: BMGT702 or BUFN702. Formerly: BMGT702.

Applications of finance concepts to definitions of investment objectives, equity analysis, portfolio analysis and management, and investment performance evaluation. Cases and studies of actual securities. Emphasis on fundamental analysis and stock recommendations.

BUFN 714 Advanced Financial Management (3 credits)

Credit only granted for: BMGT741 or BUFN714. Formerly: BMGT741.

Advanced corporate finance course that builds on the core course. Study of investment and financing decisions faced by firms at various stages in their life cycles. Topics include advanced capital budgeting and capital structure, real options and option-like features in securities, financial contracting, governance, financial distress, and capital-raising transactions ranging from IPOs for young firms to complex hedging strategies for large firms. Pedagogy uses mix of lectures and case studies.

BUFN 716 Financial Restructuring and Strategy (3 credits)

Prerequisite: BUSI640. Credit only granted for: BMGT742 or BUFN716. Formerly: BMGT742.

Integration and extension of financial theory and principles to analyze financial, asset and ownership restructuring decisions. A valuation framework is used

to study strategic decisions such as mergers and acquisitions, share repurchases, exchange offers, leveraged recapitalization, joint ventures, employee stock option plans, divestitures and spin-offs.

BUFN 722 Banking and Financial Institutions (3 credits)
Prerequisite: BUSI640. Credit only granted for: BMGT745 or BUFN722. Formerly: BMGT745.
The role of financial management in banking and financial institutions. The economic role and regulation of banking and financial institutions, analysis of risks and returns on financial assets and liabilities, and the structure of assets, liabilities and capital.

BUFN 724 International Financial Management (3 credits)
Prerequisite: BUSI640. Credit only granted for: BMGT746 or BUFN724. Formerly: BMGT746.
The role of financial management in the multinational firm. The financing and managing of foreign investments, assets, currencies, imports and exports. National and international financial institutions and markets.

BUFN 726 Futures and Options Contract (3 credits)
Prerequisite: BUSI640. Credit only granted for: BMGT744 or BUFN726. Formerly: BMGT744.
The institutional features and economic rationale underlying markets in futures and options. Valuation of futures and options. Hedging, speculation, structure of futures prices, interest rate futures, efficiency in futures markets, and stock and commodity options.

BUFN 731 Fixed Income Securities (3 credits)
Prerequisite: BUFN700. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Focuses on understanding financial instruments that have market values which are sensitive to interest rate movements. Develop tools to analyze interest rate sensitivity and value fixed income securities. Topics include a variety of fixed income assets and related securities, including: zero coupon government bonds; coupon bearing government bonds; exchange-traded bond options; bonds with embedded options; floating rate notes; caps, collars and floors; floating rate notes with embedded options; forward contracts; interest rate swaps; bond futures and options on bond futures.

BUFN 735 Computational Finance (3 credits)
Prerequisite: BUSI630 and BUSI640.
Introduces and applies various computational techniques useful in management of equities and fixed income portfolios, valuation of financial derivatives, such as stock options, valuation of fixed income securities and their derivatives. Techniques include portfolio Monte Carlo Simulation, binomial and Black-Scholes option pricing models, value at risk and stochastic processes.

BUFN 738 Investment Fund Management (3 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Repeatable to 9 credits.
Provides second-year Master in Business Administration students with the opportunity to apply the skills learned in finance classes to actual investment decisions through management of an investment fund.

BUFN 740 Capital Markets (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Designed to deepen the foundations necessary to finance focused students, especially those intending to specialize in the quantitative areas of finance including investments, fixed income, and financial engineering.

BUFN 750 Valuation in Corporate Finance (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN714 or BUFN750. Formerly: BUFN714.
An advanced topics course in Corporate Finance dealing with valuation. Main topics will be, building pro forma statements, cost of capital, using ratios and comparables to value projects and firms, dicounted cash flow valuations, WACC and APV methods of valuation and Real Option Valuations.

BUFN 751 Financial Strategy For Corporations (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
An advanced course in corporate finance, focusing on the issues that firms face when they plan to raise external capital from financial markets. The focus is on the financing problems faced by mid-market to large firms and on capital raised from public markets. The forms of external finance vary from simple debt or equity to more complex securities that bundle with an element of risk management.

BUFN 752 Financial Restructuring (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN716 or BUFN752. Formerly: BUFN716.
Focuses on identifying ways to increase firm value through corporate restructuring. Specific topics include: mergers and tender offers, spin-offs, carve-outs, divestitures, takeover defense strategies, leveraged buy-outs, and international acquisitions. Additionally, the theory, practice and empirical evidence related to each of these topics will be covered. Emphasis will be placed on valuation analysis and strategic considerations.

BUFN 753 Corporate Governance and Performance (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Deals with corporate governance and its impact on shareholder value. Divergence of interests between corporate insiders and providers of funds leads to agency problems which can impair corporate performance and shareholder value. Various instruments of corporate governance - internal as well as external mechanisms - that can help align managerial incentives with those of outside investors, and hence help restore shareholder value will be studied.

BUFN 754 Corporate Risk Management (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Surveys the theory and practice of financial risk identification, measurement, and mitigation at financial and non-financial firms. Topics will include hedging with options and futures, interest rate risk management, Value-at-Risk (VaR), Cashflow-at-Risk (CaR), Earnings-at-Risk (EaR), credit risk, equity risk, commodities risk, exchange rate risk, and lessons from risk management disasters.

BUFN 755 Entrepreneurial Finance and Private Equity (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUSI647 or BUFN755. Formerly: BUSI647.

An advanced topics course in Corporate Finance. The major emphasis is how financiers help growing firms - and in particular young start-ups - using different types of securities at different points in the industry's and firm's life. Financing arrangements and securities studied will include private equity funds and private financings placements, Venture Capital (VC) and preferred equity, Investment Banks through Initial Public Offerings (IPOs), Private equity finds, debt and leveraged buyouts. Students will learn additional techniques that will help them understand how financiers value firms and how to understand, plan and value different financing strategies.

BUFN 758 Special Topics in Finance (1-4 credits)

Prerequisite: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits if content differs. Formerly: BMGT798.

Selected advanced topics in the various fields of graduate study in finance.

BUFN 759 Independent Study in Finance (1-6 credits)

Repeatable to 6 credits if content differs. Formerly: BMGT708.

Independent study for Masters students in finance.

BUFN 760 Applied Equity Analysis (2 credits)

Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN702 or BUFN760. Formerly: BUFN702.

Students will learn to analyze equity securities using the basic EIC (Economy/Industry/Company) framework used in the financial industry, paying special attention to financial statement analysis. Students also will learn the primary valuation techniques used to estimate market values for equity securities.

BUFN 761 Derivative Securities (2 credits)

Prerequisite: BUFN740. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN726 or BUFN761. Formerly: BUFN726.

Standard types of derivatives contracts are presented, and illustrated as to how they are used in practice. The theory of pricing these contracts is then presented in detail. The use of static and dynamic replication strategies, and the concept of no-arbitrage strategies is illustrated in numerous ways. Standard valuation techniques are covered, and standard formulas are presented. The theory is then applied to develop specific pricing and hedging strategies for various types of derivatives on different underlying assets. The management of the exposure of various risks is covered in detail as well.

BUFN 762 Fixed Income Analysis (2 credits)

Prerequisite: BUFN740. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN731 or BUFN762. Formerly: BUFN731.

Describes important financial instruments which have market values that are sensitive to interest rate movements. Develops tools to analyze interest rate sensitivity and value fixed income securities. Defines and explains the vocabulary of the bond management business.

BUFN 763 Portfolio Management (2 credits)

Prerequisite: BUFN740. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN700 or BUFN763. Formerly: BUFN700.

Provides training that is important in understanding the investment process - the buy side of the financial world. Specifically, the objective is to provide graduate-level instruction in the following topics, both in theory and in using financial markets data to test the basic theory and practice of portfolio choice and equilibrium pricing models and their implications for efficient portfolios.

BUFN 764 Quantitative Investment Strategy (2 credits)

Prerequisite: BUFN763. Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.

Provides an introduction to quantitative techniques of selecting equities, as used commonly among long-short equity hedge funds and other quantitative equity asset management companies. Statistical factor models are developed to locate stocks with higher expected returns, based on the observable characteristics of the stocks. Implementation issues, including statistical estimation, backtesting and portfolio construction, are covered, as is performance evaluation.

BUFN 765 Fixed Income Derivatives (2 credits)

Prerequisite: BUFN762. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN731 or BUFN765. Formerly: BUFN731.

Surveys fixed income assets and related securities such as Exchange-traded bond options; bonds with embedded options; floating rate notes; caps, collars, and floors; floating rate notes with embedded options. Also surveys advanced tools for interest-rate and fixed-income portfolio management, including the use of derivative securities, and the application of binomial trees for analysis of options, and a sound understanding of stochastic yield curves.

BUFN 766 Financial Engineering (2 credits)

Prerequisite: BUFN740. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN735 or BUFN766. Formerly: BUFN735.

Develop Excel and Visual Basic (VBA) models to solve problems related to portfolio management, options valuation, fixed income securities, interest rate processes, and risk management. This course thus bridges theory with the design of algorithms and models that can be directly applied in practice.

BUFN 770 International Investment (2 credits)

Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN724 or (BUFN770 and BUFN771). Formerly: BUFN724.

Addresses international stock markets, portfolio theory, international interest rates, exchange rates and exchange rate derivatives (options, forwards, and futures), exchange rate swaps and exchange rate exposure (operating, translation, and transaction), foreign investment strategey.

BUFN 771 International Corporate and Project Finance (2 credits)

Prerequisite: BUFN770. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN724 or (BUFN770 and BUFN771). Formerly: BUFN724.

Continuation of BUFN770. Issues addressed will include captial budgeting, project financing, exhange rate exposure (operating, translation, and transaction), foreign investment strategy, and risk management.

BUFN 772 Bank Management (2 credits)

Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUFN722 or BUFN772. Formerly: BUFN722.

Analyze and discuss readings in bank

management,with primary focus on the measurement and management of risk, including credit, market, and interest rate risk. Look at the management of liquid reserves. Examine the special nature of financial institutions, incorporating their functions, policies, services, and regulation. Study the evolving nature of the financial services industry, by reading the financial press and by having outside practitioner speakers. Focus is on U.S. banks.

BUFN 773 Institutional Asset Management (2 credits)

Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Examines how money is managed by organizations such as university endowments, pension funds, mutual funds, hedge funds, and private equity funds. Involves a mixture of finance and economics and emphasizes the incentives professional money managers face within the context of the organizational structure in which they operate. Particular attention is paid to compensation structures and monitoring mechanisms.

Logistics, Business, and Public Policy (BULM)

BULM 720 The Green Supply Chain (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

In response to international regulation of carbon emissions and increasing corporate responsibility pressures, companies are seeking to develop greener supply chains. Companies such as WalMart have undergone a paradigm shift in how they manage their businesses to emphasize environmental stewardship and due diligence on product sustainability. Students are provided with key concepts and tools for designing and managing environmentally sustainable, low-impact supply chains.

BULM 722 Supply Chain Planning: Technology Applications (3 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Supply chain mangers rely on advanced technology software applications to meet the challenge of a global economy. Students are provided with hands-on experience in advanced software systems that are closely integrated with enterprise resource planning systems. Major emphasis is placed on demonstrating how these systems result in cost reductions and service improvements for global supply chains.

BULM 724 Negotiations in Supply Chain Management (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

This high experiential course will improve students' negotiation skills and capacity to acquire and effectively use power. By using a variety of assessment tools, feedback sources, skill-building exercises, and exercise debriefings, the class will increase students' negotiating self-confidence and improve their capacity to achieve win-win solutions to individual, team, and organizational problems. The course is designed to enhance students negotiating self confidence and improve students analytical skills, interpersonal skills, creativity (e.g., identifying creative solutions to conflict), and persuasive abilities.

BULM 726 Purchasing Management (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Examines purchasing methods from both a tactical and straegic viewpoint. Special emphasis is placed on developing purchasing strategies from international suppliers and the trade-offs between outsourcing and insourcing.

BULM 732 Logistics Management (3 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT772 or BULM732. Formerly: BMGT772.

Theoretical and case material is used to analyze managerial decisions related to business logistics. The many trade-offs faced by a logistics manager are examined such as the trade-off between inventory levels and mode of transportation used, the trade-off between inventory levels and customer service, and the trade-offs that should be made if they reduce total logistics costs or increase company profits.

BULM 733 Global Trade Logistics (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT773 or BULM733. Formerly: BMGT773.

Acquaints students with managerial issues in international logistics and transportation, and provides students with an understanding of issues related to import/export management and the global marketplace.

BULM 734 Assessing and Managing Supply Chain Risks (3 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Supply chain managers are facing an increasingly volatile operating environment, with constant danger of trading community disruption from business, social and environmental risks. Students are provided with a working knowledge of both the core techniques of supply chain risk assessment and mitigation; as well as best practices in establishing formal corporate supply chain risk management programs. A semester-long X-Treme Supply Chain Simulation will enable students to gain hands-on experience in navigating a computer company through a complex and risky four quarters of global business operations.

BULM 736 Executives in Supply Chain Management (3 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Designed to provide students an opportunity to engage in intensive interaction with senior supply chain executives from a cross-section of industries. Executives share their insights on leading competitive supply chains in the global marketplace, while students research the competitive supply chain dynamics of each executive's industry.

BULM 742 Global Supply Chain Resources Planning (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.

Provides students with an overall understanding of how firms use an advanced supply chain planning (ASCP) application as an integral part of their materials management process which includes such activities as production planning, materials requirements planning, and distribution requirements planning.

BULM 744 Global Supply Chain Risk Management (2 credits)

Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; and permission of BMGT-Robert H. Smith School of Business.

Explores methods to build enterprise resillience from the perspectives of the

supply chain planner and supply chain manager. Addresses concerns assessing strategic & operational risks, day to day uncertainties in demand & supply and ensuring business continuity after low probability but high impact events such as a terrorist attack or earthquake.

BULM 758 Special Topics in Logistics, Business and Public Policy (1-4 credits)

Prerequisite: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits if content differs. Formerly: BMGT798.

Selected advanced topics in the various fields of graduate study in logistics, business and public policy.

BULM 759 Independent Study in Logistics Management (1-6 credits)

Repeatable to 6 credits if content differs. Formerly: BMGT708.

Independent study for Masters students in Logistics Management.

Marketing (BUMK)

BUMK 701 Marketing Research Methods (2 credits)

Prerequisite: BUSI650 and BUSI630. Credit only granted for: BMGT752 or BUMK701. Formerly: BMGT752.

The process of acquiring, classifying and interpreting primary and secondary marketing data needed for intelligent, profitable marketing decisions. Evaluation of the appropriateness of alternative methodologies, such as the inductive, deductive, survey, observational, and experimental. Recent developments in the systematic recording and use of internal and external data needed for marketing decisions.

BUMK 706 Marketing Analysis (2 credits)

Prerequisite: BUSI650.

Introduction to modeling tools used to support marketing analysis and decision making. Applications in strategic marketing, marketing segmentation, new product development, sales promotion analysis, pricing, design of marketing mix, sales force allocation, and direct marketing. Spreadsheet driven cases and illustrative readings.

BUMK 712 Consumer Product Marketing (3 credits)

Prerequisite: BUSI650.

Focus is on strategy development at product category level. Attention to integrated marketing communications within that Extensive use of primary and secondary data. Analytical skills developed include forecasting, P&L analysis, and product category analysis. Role of the product/brand manager in customer-focused companies examined through a simulation.

BUMK 715 Consumer Behavior (2 credits)

Prerequisite: BUSI650. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT754 or BUMK715. Formerly: BMGT754.

Analysis of customer decision-making and how marketing strategy can be used to influence those decisions. The framework is a buyer behavior model, in which concepts from psychology, sociology, and economics are applied to individual and organizational purchase decisions. Marketing strategies of leading firms in consumer products, technology, and services (including internet services) are analyzed using a variety of case study formats. Focus is consumer behavior; however, principles can also be applied to the decision-making of business.

BUMK 716 Brand Management (2 credits)

Prerequisite: BUSI650. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.

Brand names are valuable assets for firms. Effective brand management is critical to maintaining the long-term profitability of products and services. Topics include understanding brands from the customer's perspective, building brand equity, measuring brand equity, leveraging brand equity, managing brand portfolios and managing brands over time.

BUMK 717 Integrated Marketing Communications (2 credits)

Prerequisite: BUSI650. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.

Marketing communications are a complex but critical component of marketing strategy. Topics include communication tools: advertising, sales promotions, corporation communications, one-on-one or direct marketing, public relations, internet communications, sponsorship/events marketing, and marketing communcation plans: defining objectives, implementing the plan, and measuring communications effectiveness. Achieving integration in the content, look, and feel of all marketing communications is stressed.

BUMK 720 eService (3 credits)

Prerequisite: BUSI650.

Management of service over electronic networks such as the internet. Focus is increasing revenues through customer acquisition and retention, due to improved service. Topics: leveraging of unique nature of the Internet to improve service, managing customer interface, managing online relationships, and development of e-service in variety of contexts,including government and education. Seminar format fosters active, give-and-take environment. Guest speakers provide contact with relevant business issues. Discussion of current issues in e-service management.

BUMK 721 Consumer Product Marketing Simulation (2 credits)

Prerequisite: BUSI650. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

The objective of the simulation is to place the student in the role of Brand Manager and give hands-on experience making the marketing decisions for an over-the-counter pharmaceutical product. In essence, PharmaSim is a flight simulator for brand managers.

BUMK 722 Customer Equity Management (2 credits)

Prerequisite: BUSI650. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).

Focuses on managing customers of a business, whether in B2B or B2C space, as a portfolio of equity; understanding the current and future value of customers to the business; selective acquisition, development, and retention of customers using latest developments in information technology.

BUMK 731 Business-to-Business Marketing (2 credits)

Prerequisite: BUSI650.

Focus is large fraction of marketing activity directed at organizational customers (businesses, non-profits and government). Marketing strategies, tactics and analytical tools most relevant when marketing to organizational customers are covered. Readings, cases and term paper contribute to understanding how to build long term buyer/seller relationships. Course is appropriate for anyone interested in understanding relationships between organizations, including vertical strategic alliances.

BUMK 736 Service Marketing and Management (2 credits)

Examines special challenges service marketing poses for managers because of the intangible, heterogeneous nature of the product, and the critical role of customer contact employees in service delivery. Strategies for meeting these challanges are addressed. Topics include 1) customer relationship management, 2) the design and execution of the service delivery process, 3) the development and implementation of employee customer service skills, 4) the measurement and

management of critical outcome variables, such as customer satisfaction, customer equity, and customer lifetime value, and 5) the role of emerging technology in customer service.

BUMK 740 Marketing High Technology Products (2 credits)

Prerequisite: BUSI650.
Examines unique characteristics of marketing in dynamic high technology industries. Explores implications for channel management, product development, and bundling of products and services to develop a unique value proposition.

BUMK 753 Global Marketing (2 credits)

Prerequisite: BUSI650. Credit only granted for: BMGT753 or BUMK753. Formerly: BMGT753.
The environmental, organizational, and financial aspects of global marketing are covered. It also describes the special marketing research, pricing, channels of distribution, product policy, and communication issues which face U.S. firms doing business in global markets.

BUMK 757 Marketing Strategy (2 credits)

Prerequisite: BUSI650. Credit only granted for: BMGT757 or BUMK757. Formerly: BMGT757.
A capstone marketing course. Marketing strategies designed to manage products in selected market segments. Topics covered include competitor analysis, buyer analysis, market segments, and product strengths and weaknesses; product related issues are identified and marketing strategies developed, assessed and implemented.

BUMK 758 Special Topics in Marketing (1-4 credits)

Restriction: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits. Formerly: BMGT798.
Selected advanced topics in the various fields of graduate study in marketing.

BUMK 759 Independent Study in Marketing (1-6 credits)

Repeatable to 6 credits if content differs. Formerly: BMGT708.
Independent study for Masters students in Marketing.

Management and Organization (BUMO)

BUMO 702 Managerial Staffing (3 credits)

Credit only granted for: BMGT783 or BUMO702. Formerly: BMGT783.
Aimed at increasing an understanding of the legal, technical, and practical issues involved in organizational staff forecasting, and hiring and termination procedures.

BUMO 704 Problems and Applications in Human Resource Management (3 credits)

Prerequisite: BUSI663. Credit only granted for: BMGT761 or BUMO704. Formerly: BMGT761.
Applications in the design, implementation, and evaluation of human resource management programs. Experiential learning activities and simulations.

BUMO 712 Leadership Development (3 credits)

Prerequisite: BUSI664. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Focuses on developing skills to inspire, influence and organize others to accomplish key goals. Building on leadership theories, course includes assessment & role-playing activities, discussions, cases, and exercises to assess and develop personal capabilities.

BUMO 714 Competitive and Collaborative Negotiation (2 credits)

Corequisite: BUMO715. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUMO714 or BMGT764. Formerly: BMGT764.
Increase negotiating self-confidence and improve capacity to achieve win-win solutions to organizational problems. Improve effectiveness at finding creative solutions to conflict.

BUMO 715 Advanced Negotiation Challenges (2 credits)

Corequisite: BUMO714. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Practice negotiations using multiple media (email, phone). Multiple party negotiations. Cross-cultural negotiations.

BUMO 720 Understanding Organizational Change (2 credits)

Prerequisite: BUSI664 or BUSI662. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Develops the fundamental change knowledge and skills of MBA students who plan to work with organizations as change agents, whether internally as managerial employees or externally as outside consultants. Draws on literatures from organizational behavior, human resource management and strategic management to identify models as prescriptions of change.

BUMO 721 Managing Organizational Change (2 credits)

Prerequisite: BUMO720. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Develops the advanced knowledge and skills of MBA students who plan to work with organizations as change agents. Concrete and useful strategies, tools, and interventions for diagnosing organizational change situations, analyzing problems, and designing and implementing organizational change. Diverse approaches to leading and managing various types of organizational change.

BUMO 722 Organizational Behavior: A Multicultural Perspective (3 credits)

Credit only granted for: BMGT765 or BUMO722. Formerly: BMGT765.
Study of organizational behavior from a multicultural perspective.

BUMO 725 Networks and Influence (2 credits)

Restriction: Must be in Business and Management (Master's) program.
Focuses on networks, social capital, and influence as they relate to operating effectively in organizations. It draws heavily on emerging literature related to social capital and networks, but also integrates concepts from persuasion, communication, and motivation literatures to aid your efforts to build a successful track record for yourself and your organization.

BUMO 727 The Entrepreneur and the Entrepreneurial Team (3 credits)

Prerequisite: Completion of MBA core requirements; and permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT781 or BUMO727. Formerly: BMGT781.
The entrepreneur and the entrepreneurial team: the entrepreneur and the team as it relates to innovation, change, power, and risk-taking. Entrepreneurs and their teams from a variety of different firms present and discuss their views on leadership.

BUMO 730 Corporate Venturing (3 credits)

Prerequisite: Must have completed

MBA core requirements; and permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT782 or BUMO730. Formerly: BMGT782.
This course explores the skills, techniques, and strategies that are required to instill entrepreneurial behavior in large complex organizations. Students study presentations from real executives and business cases wherein creativity, innovation, fast descision-making, and trial and error implementation have been applied successfully.

BUMO 732 Entrepreneurship and New Ventures (2 credits)
Credit only granted for: BUMO732 or BUSI660. Formerly: BMGT780.
Provides an introduction to important tools and skills necessary to create and grow a successful new venture. Integrates research findings from a range of different practical and intellectual perspectives, including psychology, sociology, economics, strategic management, and history into practical, hands on lessons for an entrepreneur. Class projects provide the foundations for new, real businesses.

BUMO 743 Technology Transfer Commercialization Strategies (3 credits)
Restriction: Must be in Business and Management (Master's) program. Credit only granted for: BMGT785 or BUMO743. Formerly: BMGT785.
Viewing technology as a strategic resource of the firm, students develop an understanding of the processes, risks, and rewards of technology commercialization. Student teams are organized to review and select a technological innovation and then determine its commercial viability in the market place.

BUMO 744 Creation of High Potential Ventures (3 credits)
Restriction: Must be in Business and Management (Master's) program. Credit only granted for: BMGT787 or BUMO744. Formerly: BMGT787.
This course focuses on the real life experiences of high profile technology entrepreneurs. Guest entrepreneurs and book review reveal patterns of personal preparation, strategic decision-making, and action that have produced ventures with high value-added and significant regional and national impact.

BUMO 748 Business Plan Review (3 credits)
Repeatable to 6 credits. Formerly: BMGT796.
Evaluation of real business plans submitted to the Dingman Center for Entrepreneurship. Practicing venture capitalist and professors focus on business plan critique and writing skills, venture capitalist screening practices, and the structure of electronic commerce. Past business plan reviews are analyzed according to the business model, target market, competitive advantages/threats, stage of development, management team and financial status. Real investment decisions are made on the basis of student recommendations. Subject companies are contacted and evaluated.

BUMO 751 Implementing Strategy: Organizing to Compete (2 credits)
Prerequisite: Must have completed or be concurrently enrolled in BUSI690. And must have completed MBA core requirements; or permission of BMGT-Robert H. Smith School of Business.
Organizational dynamics of competitive advantage. Impact of alternative organizational structures, planning and control systems, human resource management practices, and executive leadership styles on the implementation of archetypically different strategies.

BUMO 752 Strategic Growth for Emerging Companies (2 credits)
Restriction: Must be in Business and Management (Master's) program.
Explores the key elements of mastering the move from being a successful small company to achieving industry significance. Supplemented by readings, video and guest speakers, the course highlights the application of practical lessons leading to strategic growth and subsequent emergence as a player.

BUMO 753 Emerging Business Formation (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Business formation issues, legal obligations that affect entrepreneurial activities, the spectrum of financing methods available to emerging businesses, creating management and organization and a practical application of the tools through practical projects.

BUMO 754 Global Strategy (2 credits)
Credit only granted for: BUSI674 or BUMO754. Formerly: BMGT795.
Focuses on the "strategic" and "organizational" questions that a company must address as it globalizes its footprint. Among the questions that will be addressed are: What are the potential benefits, costs, and risks associated with going abroad? What differentiates a "global" from a "multidomestic" industry? What are the sources of competitive advantage in a global context?

BUMO 756 Industry Analysis (2 credits)
Recommended: BUSI690. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT792 or BUMO756. Formerly: BMGT792.
Conceptual framework and analytical tools for understanding the dynamics of industry structure. Impacts of past and future attractiveness of the industry on profitability. Developing and applying frameworks to devise competitive strategies in uncertain industries.

BUMO 757 Competitor Analysis (2 credits)
Recommended: BUSI690. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Understanding of the dynamics of how competitors interact in the marketplace. Understanding economic and behavioral motivations of industry players to design more effective strategies.

BUMO 758 Special Topics in Management and Organization (1-4 credits)
Restriction: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits if content differs. Formerly: BMGT798.
Selected advanced topics in the various fields of graduate study in management and organization.

BUMO 759 Independent Study in Management and Organization (1-6 credits)
Repeatable to 6 credits if content differs. Formerly: BMGT708.
Independent study for Masters students in management and organization.

BUMO 761 Creativity for Business Leaders and Entrepreneurs (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUSI661 or BUMO761. Formerly: BUSI661.
Examines the concept of creativity as it applies in today's and tomorrow's complex business environment. An overview of the cognitive foundations of creativity, examines many of the preconceived notions about creativity in business and discusses multiple ways in which creativity can help business leaders and entrepreneurs to succeed. Topics include creativity techniques for groups and individuals, creativity as a foundation to recognize business opportunities and develop innovative products and services, selecting ideas and making them stick, mental and organizational obstacles to creativity as well as an overview of electronic tools to increase creative capability.

BUMO 767 Cross-Cultural Communication and Teamwork (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI667 or BUMO767. Formerly: BUSI667.
Provide managers a sound basis for developing such competencies. Specifically, we will develop an understanding of key cultural differences, and how these differences influence the management of individuals, groups, and organizations.

BUMO 777 Technology Commercialization (3 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Students will build commercialization plans for University of Maryland Technologies protected by the Office of Technology Commercialization. Students will learn different mechanisms for successful technology transfer and work closely with the instructor, the Dingman Center managing director and affiliated professionals. Successful students may pursue additional funding through the Dingman Center to support further commercialization efforts.

BUMO 794 Essentials of Negotiation (2 credits)
Restriction: Must be in Business and Management (Master's) program.
This highly experiential course will improve students' negotiation skills and capacity to acquire and effectively use bargaining power. By using a variety of assessment tools, feedback sources, skill-building exercises, and exercise debriefings, the class will increase students' negotiating self-confidence and improve their capacity to claim value and achieve win-win solutions to individual, team, and organizational problems. The course is designed to enhance students' negotiating self-confidence and improve students' analytical and decision-making skills (e.g., understanding bargaining zones, knowing when an agreement can be made and when to walk away; learning how to prepare for negotiations), interpersonal skills, creativity (e.g., identifying creative solutions to conflict), and persuasive abilities.

BUMO 796 Leadership and Human Resource Management for Accountants and Auditors (3 credits)
Restriction: Must be in Business and Management (Master's) program.
Develops the concepts, frameworks, and skills that are important to be effective leaders and to successfully manage human resources. Topics for discussion include: Creating a motivating and empowering environment; leadership attributes, power and effective influence; building effective decision-making; strategic management of human resources; specification of the skills and competencies requisite for job success; recruiting and selecting employees to fit the job and the organization; measuring, appraising and improving performance. All of the topics selected for discussion are critical ones that every professional needs to know, regardless of functional area (not just HR professionals), and will help students become more effective consultants, managers and leaders.

MBA Core and Cross-Functional (BUSI)

BUSI 603 Communications Mastery Program II (.50 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT603, BMGT615, or BUSI603. Formerly: BMGT603.
Part II of the Communications Mastery Program is a continuation of Phase I, with the goal of assisting students in demonstrating mastery in their communication skills. The phase will allow students fo further integrate these skills into the Smith curriculum, including course electives, career development activities and the Group Consulting Project.

BUSI 604 Business Case Competition (1 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT604, BMGT615, or BUSI604. Formerly: BMGT604.
This competition integrates oral and written assignments and individual assessments culminating in a seven day competition. During this competition students will integrate elements from their various courses and demonstrate mastery of their communications skills. Teams are given a business case that deals with the broad strategy issues facing a company. The teams present their analyses and recommendations in written and oral presentations. In a multistage competition, teams will be selected to advance to the final round, which is judged by a panel of business leaders who play the role of the company's board of directors.

BUSI 605 Culture, Ethics and Communication (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Provides an opportunity for student discussion, debate, and dramatization of topics relating to ethics, corporate social responsibility, and culture relevant to the current business environment. Such issues are brought to life through a project relating to corporate social responsibility, guest speakers, role-plays, and student-created dramatic performances.

BUSI 608 ELM: Special Topics (credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Formerly: BMGT608.
Selected advanced topics in the various fields of graduate study in business and management.

BUSI 610 Introduction to Financial Accounting (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Overview of financial accounting, periodic financial statements and the financial reporting process. Importance of financial statements as information source for creditors and investors and as a means by which managers can communicate information about their firms.

BUSI 611 Managerial Accounting (2 credits)
Prerequisite: BUSI610. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Use of accounting data in corporate planning and control. Cost-volume- profit analysis, budgeting, pricing decisions and cost data, transfer pricing, activity-based management, performance measures, and standard costing.

BUSI 620 Strategic Information Systems (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT620 or BUSI620. Formerly: BMGT620.
Use of information technology to achieve competitive advantage, efficient operations, and effective decision making. Analysis of functions of information technology and its impact on competitive strategy and organizational operations.

BUSI 621 Strategic and Transformational IT (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith

School of Business. Credit only granted for: BUSI620 or BUSI621.
Introduces students to the key issues in managing information technology (IT) and provides an overview of how major IT applications in today's firms support strategic, opertaional, and tactical decisions. Topics include: synchroizing IT and business strategy; the transformational impacts of IT; evaluating and coping with new technologies; governing, managing, and organizing the IT function including outsourcing/offshoring considerations; assessing the business value of IT and justifying IT projects; and managing IT applications in functional areas to support strategy and business process.

BUSI 622 Managing Digital Business Markets (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
The objective is to understand the strategic and tactical issues involved in managing digital businesses and markets. Also, some of the characteristics of digital businesses and markets that make them unique and understand how companies can best manage them will be examined.

BUSI 630 Data, Models and Decisions (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Analytical modeling of business decisions; uncertainty, risk and expected utility; regression modeling to infer relationships among variables.

BUSI 634 Operations Management (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Operations management is concerned with efficient and effective design and operation of business processes for delivering products and/or services. Emphasis is given to process analysis and design, capacity management and bottlenecks, waiting lines and the impact of uncertainty in process performance, quality management, lean, six-sigma, and revenue management.

BUSI 640 Financial Management (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Focuses on the valuation of the real assets of firms as well as the valuation of stocks and bonds, the primary financial assets in an economy. While details vary, the conceptual foundations of valuation boil down to three themes: time value of money, no-arbitrage, and systematic risk.

BUSI 647 Entrepreneurial Finance and Private Equity (2 credits)
Prerequisite: BUSI640. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
An advanced topics course in Corporate Finance. The major emphasis is how financiers help firms plan for growth and finance firms using different types of securities at different points in the industry's and firm's life. Securities will include private financings and placements, Venture Capital (VC), Initial Public Offerings (IPOs), Private Equity and Leveraged Buyouts.

BUSI 650 Marketing Management (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Analysis of marketing problems and evaluation of specific marketing efforts regarding the organization's products and services, pricing activities, channel selection, and promotion strategies in both domestic and international markets.

BUSI 660 Entrepreneurship and New Ventures (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BUMO732 or BUSI660.
Provides an introduction to important tools and skills necessary to create and grow a successful new venture. Integrates research findings from a range of different practical and intellectual perspectives, including psychology, sociology, economics, strategic management, and history into practical, hands on lessons for an entrepreneur. Class projects provide the foundations for new, real businesses.

BUSI 662 Leadership and Teamwork (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Course examines concepts of team-building and leadership which are critical to managerial success. Topics include leadership, decision making, communication and conflict, work motivation, building effective teams, and organizational change and culture.

BUSI 663 Managing Human Capital (2 credits)
Prerequisite: BUSI662. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: BMGT663 or BUSI663. Formerly: BMGT663.
Course examines core human resource management principles and emphasizes skills for maximizing an organization's human capital. Topics include recruitment, selection, performance feedback and incentives, termination of poor performers, and managing organizational change through human resource systems and policies.

BUSI 664 Leadership and Managing Human Capital (3 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Credit only granted for: (BUSI662 and BUSI663) or BUSI664.
Examines concepts of leadership and human resource management principles. Emphasizes skill building and creating a competitive advantage by creating a culture that develops extraordinary leaders and unleashes employee talent. Topics include leadership, decision making, communication and conflict, work motivation, teams, ensuring legal compliance and leveraging diversity, recruiting, selecting and retaining qualified employees who fit the job and the organization, measuring performance and providing feedback, and managing changes in leadership and HR strategy.

BUSI 665 Integration and Teamwork (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Provides students with the concepts, frameworks, tools and skills necessary for thinking and working in an integrative fashion across functional areas of a business in a team based environment.

BUSI 671 Supply Chain Logistics and Operations Management (2 credits)
Credit only granted for: BMGT671 or BUSI671. Formerly: BMGT671.
This course introduces students to the concept of value-driven supply chains and its integration with operations. The course focuses on the fundamental principles underlying supply chains, using insights from both operations management and logistics.

BUSI 672 Global Supply Chain Management (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Offers a practical blueprint for understanding, building, implementing, and sustaining supply chains in today's rapidly changing global supply chain environment. It will provide the student with a survey of the fast-moving Supply Chain Management discipline and practice, including the evolution of supply chain strategies, business models and technologies; current best practices in demand and supply management; and methodologies for conducting supply chain-wide diagnostic assessments and formulating process improvement plans.

BUSI 673 International Economics for Managers (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Focuses on understanding critical aspects of the global business environment that influence firm decisions and behavior. Globalization is present in market competition, capital markets, and managerial talent as evidenced by free trade areas and economic unions forming, the volatility in global financial markets, and the continued rise of transnational firms. With globalization, the challenge for firms is to acknowledge, understand and act when appropriate - to act by sourcing, lobbying, and relocating value chain activities internationally.

BUSI 674 Globalizing the Enterprise (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Focuses on the "strategic" and "organizational" questions that a company must address as it globalizes its footprint. Among the questions that will be addressed are: What are the potential benefits, costs, and risks associated with going abroad? What differentiates a "global" from a "multidomestic" industry? What are the sources of competitive advantagein a global context?

BUSI 681 Managerial Economics and Public Policy (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Basic microeconomic principles used by firms, including supply and demand, elasticities, costs, productivity, pricing, market structure and competitive implications of alternative market structures. Market failures and government intervention. Public policy processes affecting business operations.

BUSI 683 The Global Economic Environment (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Relationship between national and international economic environments. Determinants of output, interest rates, prices and exchange rates. Analysis of effect of economic policies (fiscal, monetary, trade, tax) on the firm and the economy.

BUSI 690 Strategic Management (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)).
Analyze and identify profit opportunities and threats in different industry and competitive environments; Analyze and identify a firm's valuable assets, resources and capabilities and how they might be protected, leveraged, and extended in the market; Learn how to organize your company to be the best prepared to adapt its strategy over time as the market environment changes; and how to use organic growth as well as mergers, acquisitions, joint ventures, alliances, and divestitures to ensure that the firm maintians the proper scale and scope to compete effectively over time.

BUSI 691 Integrative Business Plan Competition (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Designed to inspire and enable students to develop new business products, services, processes and management models. Three-person teams create a business plan to commercialize an innovation and submit the plan to the MBA business plan competition. The plan can involve creation of independent ventures or ventures within an established business.

BUSI 698 MBA Consulting Project (3-6 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)). Repeatable to 9 credits if content differs. Formerly: BMGT698.
Experiental research project in the identification of management problems, the evaluation of alternative solutions, and the recommendation for management.

BUSI 758 Special Topics in Business (1-4 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business. Repeatable to 9 credits if content differs. Formerly: BMGT798.
Selected advanced topics in the various fields of graduate study in business.

BUSI 759 Independent Study in Business (1-6 credits)
Repeatable to 6 credits if content differs. Formerly: BMGT708.
Independent study for Masters students in Business.

BUSI 761 The Environment of International Business (2 credits)
Credit only granted for: BMGT794 or BUSI761. Formerly: BMGT794.
The international business environment as it affects company policy and procedures. In-depth analysis and comprehensive case studies of the business functions undertaken in international operations.

BUSI 764 Business Law for Managers (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT793 or BUSI764. Formerly: BMGT793.
Survey of United States legal institutions and processes as well as substantive areas of the law that affect business. Examination of tort and contract law, the legal forms of business organization and legal liability and major regulatory laws that affect business.

BUSI 765 Business Ethics (2 credits)
Survey of applied topics in business ethics, focusing on corporate social responsibility, relationship of law and ethics, and individual ethical decision making.

BUSI 771 New Venture Financing (2 credits)
Prerequisite: BUSI640; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT740 or BUSI771. Formerly: BMGT740.
Development of skills for financing new ventures (both small and potentially large). Exploration of various funding sources. Criteria used in evaluation and decision process, including commercial banks, venture capital companies, small business investment companies, underwriters, private placement-financial consultants, mortgage bankers, and small business innovative research grants (U.S. Government).

BUSI 780 Managing Digital Businesses and Markets (3 credits)
Prerequisite: BUSI620. Credit only granted for: BMGT723 or BUSI780. Formerly: BMGT723.
Provides an overview of business models and strategy in the electronic marketplace. Focus is placed on critical success factors in digital businesses, and reasons for failures. It will provide an understanding of the role of emerging information technologies for enabling new business models and markets, and strategic issues of building companies in the digital world.

BUSI 783 Information Technology Fundamentals for Managers (3 credits)
Designed for students who do not already have a strong technology background, this course provides an overview of a broad range of information and communication technologies, emphasizing networks and distributed computing. Other topics include hardware and operating systems, software development tools and processes, relational databases, security and cryptography, enterprise applications and electronic commerce.

BUSI 785 Project Management in Dynamic Environments (2 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
Addresses project management skills that are required by successful managers in increasingly competitive and faster-moving environments. Examines fundamental concepts of successful project management, and the technical and managerial issues, methods, and techniques.

BUSI 788 Introduction to Global Business Experience (1 credits)
Restriction: Must be in a major in BMGT-Robert H. Smith School of Business.
Introduction to the economic climate of the country and region, history, political influences on business landscape, and specific opportunities and threats of doing business in the destination country. Course is a prerequisite to short-term study abroad classes.

BUSI 791 Management of High Technology, Research and Development (3 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BMGT776 or BUSI791. Formerly: BMGT776.
The creation of competitive advantages through the use of new technology. The integration of technological strategy with business strategy within the internal corporate culture. Research and development in the context of this strategy-structure of the firm. The nature of Research and Development, the management of creativity, and new product development are also discussed.

BUSI 798 Global Business Experience (2-4 credits)
Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business. Repeatable to 6 credits if content differs.
Provides MBA students the opportunity to combine classroom learning and project research with seminars in a host country. The focus and locations visited will vary.

BUSI 799 Masters Thesis Research (1-6 credits)

Full-Time MBA Program (BUSM)

BUSM 600 Leadership and Teamwork (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI662 or BUSM600.
Course examines concepts of team-building and leadership which are critical to managerial success. Topics include leadership, decision making, communication and conflict, work motivation, building effective teams, and organizational change and culture.

BUSM 602 Introduction to Financial Accounting (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI610 or BUSM602.
Overview of financial accounting, periodic financial statements and the financial reporting process. Importance of financial statements as information source for creditors and investors and as a means by which managers can communicate information about their firms.

BUSM 604 Managerial Economics and Public Policy (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI681 or BUSM604.
Basic microeconomic principles used by firms, including supply and demand, elasticities, costs, productivity, pricing, market structure and competitive implications of alternative market structures. Market failures and government intervention. Public policy processes affecting business operations.

BUSM 606 Data, Models and Decisions (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI630 or BUSM606.
Analytical modeling of business decisions; uncertainty, risk and expected utility; regression modeling to infer relationships among variables.

BUSM 610 Financial Management (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI640 or BUSM610.
Focuses on the valuation of the real assets of firms as well as the valuation of stocks and bonds, the primary financial assets in an economy. While details vary, the conceptual foundations of valuation boil down to three themes: time value of money, no-arbitrage, and systematic risk.

BUSM 612 Marketing Management (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI650 or BUSM612.
Analysis of marketing problems and evaluation of specific marketing efforts regarding the organization's products and services, pricing activities, channel selection, and promotion strategies in both domestic and international markets.

BUSM 614 Strategic Management (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI690 or BUSM614.
Analyze and identify profit opportunities and threats in different industry and competitive environments; Analyze and identify a firm's valuable assets, resources and capabilities and how they might be protected, leveraged, and extended in the market; Learn how to organize your company to be the best prepared to adapt its strategy over time as the market environment changes; and how to use organic growth as well as mergers, acquisitions, joint ventures, alliances, and divestitures to ensure that the firm maintians the proper scale and scope to compete effectively over time.

BUSM 616 Managerial Accounting (2 credits)
Prerequisite: BUSI610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI611 or BUSM616.
Use of accounting data in corporate planning and control. Cost-volume- profit analysis, budgeting, pricing decisions and cost data, transfer pricing, activity-based management, performance measures, and standard costing.

BUSM 621 Strategic and Transformational IT (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI621 or BUSM621.
Introduces students to the key issues in managing information technolog (IT) and provides an overview of how major IT applications in today's firms support strategic, opertaional, and tactical decisions. Topics include: synchroizing IT and business strategy; the transformational impacts of IT; evaluating and coping with new technologies; governing, managing, and organizing the IT function including outsourcing/offshoring considerations; assessing the business value of IT and justifying IT projects; and managing IT applications in functional areas to support strategy and business process.

BUSM 622 Managing Digital Business Markets (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI622 or BUSM622.
The objective is to understand the strategic and tactical issues involved in managing digital businesses and markets. Also, some of the characteristics of digital businesses and markets that make them unique and understand how companies can best manage them will be examined.

BUSM 624 Operations Management (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI634 or BUSM624.
Operations management is concerned with efficient and effective design and operation of business processes for delivering products and/or services. Emphasis is given to process analysis and design, capacity management and bottlenecks, waiting lines and the impact of uncertainty in process performance, quality management, lean, six-sigma, and revenue management.

BUSM 626 The Global Economic Environment (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI683 or BUSM626.
Relationship between national and international economic environments. Determinants of output, interest rates, prices and exchange rates. Analysis of effect of economic policies (fiscal, monetary, trade, tax) on the firm and the economy.

BUSM 702 Consumer Behavior (2 credits)
Prerequisite: BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMK715 or BUSM702.
Analysis of customer decision-making and how marketing strategy can be used to influence those decisions. The framework is a buyer behavior model, in which concepts from psychology, sociology, and economics are applied to individual and organizational purchase decisions. Marketing strategies of leading firms in consumer products, technology, and services (including internet services) are analyzed using a variety of case study formats. Focus is consumer behavior; however, principles can also be applied to the decision-making of business.

BUSM 703 Marketing Strategy (2 credits)
Prerequisite: BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMK757 or BUSM703.
A capstone marketing course. Marketing strategies designed to manage products in selected market segments. Topics covered include competitor analysis, buyer analysis, market segments, and product strengths and weaknesses; product related issues are identified and marketing strategies developed, assessed and implemented.

BUSM 704 New Product Development (2 credits)
Prerequisite: BUSM612. Restriction: Must be in one of the following programs (Business and Management (Master's); Business and Management (Master's)) ; or permission of BMGT-Robert H. Smith School of Business.
This course focuses on the development of innovations, new products or new services from the perspective of a marketer. For an innovation to be successful in the market, it has to be customer centric: hence, in this course, we study how to develop and bring to market elegant and efficient solutions to strong customer needs. This is a fundamental business challenge, faced while working in a startup or in an established company; when developing a new product or a new service; and when serving customers who are individuals or large corporations.

BUSM 705 Brand Management (2 credits)
Prerequisite: BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMK716 or BUSM705.
Brand names are valuable assets for firms. Effective brand management is critical to maintaining the long-term profitability of products and services. Topics include understanding brands from the customer's perspective, building brand equity, measuring brand equity, leveraging brand equity, managing brand portfolios and managing brands over time.

BUSM 706 Innovation & Product Development (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMO758G or BUSM783.
Designed to give students a broad view on issues related to the management of innovations. It covers both external dynamics of innovations and internal management activities, with special emphasis on knowledge development and learning processes within organizations.

BUSM 708 Independent Study in Business (1-6 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Repeatable to 6 credits if content differs.
Independent study for Masters students in Business.

BUSM 710 Advanced Marketing Analytics Models (2 credits)
Prerequisite: BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMK706 or BUSM705.
Introduction to modeling tools used to support marketing analysis and decision making. Applications in strategic marketing, marketing segmentation, new product development, sales promotion analysis, pricing, design of marketing mix, sales force allocation, and direct marketing. Spreadsheet driven cases and illustrative readings.

BUSM 711 Pricing Strategies for Sustainable Competitive Advantage (2 credits)
Prerequisite: BUSM612. Restriction: Must be in Business and Management

(Master's) program; or permission of BMGT-Robert H. Smith School of Business.
Pricing is one of the most important marketing decisions a firm faces. This course will help participants to develop pricing strategies using actual proven concepts, processes and techniques, to align pricing strategies with corporate goals and objectives, to determine the value customers assign to products and services using competitive pricing analysis, and to optimize pricing using customer segmenting strategies. The course will focus on both economic and behavioral aspects of pricing, and evaluation of innovative pricing practices such as price matching, customized pricing, bundle pricing and product line pricing, covering both B2B and B2C markets. Instruction will be through a mix of case studies, pricing simulation games, hands-on exercises and discussions. The course will provide participants with an in-depth understanding of state-of-the-art pricing strategies, practices and techniques for making profitable and sustainable pricing decisions.

BUSM 713 Market Forecasting (2 credits)

Prerequisite: BUSM606 and BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business.
Students will learn a number of market forecasting methods, each appropriate for different contexts. The majority of this course focuses on quantitative modeling techniques based on established statistical methods. We also cover non-statistical methods that are often used when empirical data is scarce. This is a very hands-on class where students will apply the forecasting methods learned to real data.

BUSM 714 Integrated Marketing Communications (2 credits)

Prerequisite: BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMK717 or BUSM707.
Marketing communications are a complex but critical component of marketing strategy. Topics include communication tools: advertising, sales promotions, corporation communications, one-on-one or direct marketing, public relations, internet communications, sponsorship/events marketing, and marketing communcation plans: defining objectives, implementing the plan, and measuring communications effectiveness. Achieving integration in the content, look, and feel of all marketing communications is stressed.

BUSM 716 Social Media and Internet Marketing (2 credits)

Prerequisite: BUSM612. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business.
Examines the process of developing, implementing, and analyzing strategies for successfully marketing a variety of existing and potential products and services using electronic media. Besides well-established Internet marketing tools such as e-mail, search engines and display advertising, a substantial part of the course is dedicated to understanding social media, analyzing successful social media strategies, and tracking their effectiveness. The course offers hands-on experience with many popular as well as emerging techniques unique to electronic media. Special attention is given to metrics appropriate for the new media.

BUSM 731 Capital Markets (2 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN740 or BUSM731.
Designed to deepen the foundations necessary to finance focused students, especially those intending to specialize in the quantitative areas of finance including investments, fixed income, and financial engineering.

BUSM 733 Valuation in Corporate Finance (2 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN750 or BUSM733. Formerly: BUFN750.
An advanced topics course in Corporate Finance dealing with valuation. Main topics will be, building pro forma statements, cost of capital, using ratios and comparables to value projects and firms, dicounted cash flow valuations, WACC and APV methods of valuation and Real Option Valuations.

BUSM 735 Financial Strategy for Corporations (2 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN751 or BUSM735. Formerly: BUFN751.
An advanced course in corporate finance, focusing on the issues that firms face when they plan to raise external capital from financial markets. The focus is on the financing problems faced by mid-market to large firms and on capital raised from public markets. The forms of external finance vary from simple debt or equity to more complex securities that bundle with an element of risk management.

BUSM 736 Corporate Risk Management (2 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN754 or BUSM736.
Surveys the theory and practice of financial risk identification, measurement, and mitigation at financial and non-financial firms. Topics will include hedging with options and futures, interest rate risk management, Value-at-Risk (VaR), Cashflow-at-Risk (CaR), Earnings-at-Risk (EaR), credit risk, equity risk, commodities risk, exchange rate risk, and lessons from risk management disasters.

BUSM 737 Applied Equity Analysis (2 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN760 or BUSM737.
Students will learn to analyze equity securities using the basic EIC (Economy/Industry/Company) framework used in the financial industry, paying special attention to financial statement analysis. Students also will learn the primary valuation techniques used to estimate market values for equity securities.

BUSM 738 Investment Fund Management (1-4 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; and permission of BMGT-Robert H. Smith School of Business. Repeatable to 12 credits. Credit only granted for: BUFN738 or BUSM738.
Provides second-year Master in Business Administration students with the opportunity to apply the skills learned in finance classes to actual investment decisions through management of an investment fund.

BUSM 741 Financial Restructuring (2 credits)

Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN752 or BUSM741.
Focuses on identifying ways to increase firm value through corporate restructuring. Specific topics include: mergers and tender offers, spin-offs, carve-outs, divestitures, takeover defense strategies, leveraged buy-outs, and international acquisitions. Additionally, the theory, practice and empirical evidence related to each of these topics will be covered. Emphasis will be placed on valuation analysis and strategic considerations.

BUSM 743 Entrepreneurial Finance and Private Equity (2 credits)
Prerequisite: BUSM610. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN755 or BUSM743.
An advanced topics course in Corporate Finance. The major emphasis is how financiers help growing firms - and in particular young start-ups - using different types of securities at different points in the industry's and firm's life. Financing arrangements and securities studied will include private equity funds and private financings placements, Venture Capital (VC) and preferred equity, Investment Banks through Initial Public Offerings (IPOs), Private equity finds, debt and leveraged buyouts. Students will learn additional techniques that will help them understand how financiers value firms and how to understand, plan and value different financing strategies.

BUSM 744 Portfolio Management (2 credits)
Prerequisite: BUSM610; and BUSM731. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUFN763 or BUSM744.
Provides training that is important in understanding the investment process - the buy side of the financial world. Specifically, the objective is to provide graduate-level instruction in the following topics, both in theory and in using financial markets data to test the basic theory and practice of portfolio choice and equilibrium pricing models and their implications for efficient portfolios.

BUSM 747 Financial Reporting & Analysis (2 credits)
Prerequisite: BUSM602. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business.
Uses authoritative professional pronouncements to examine advanced financial reporting issues. Examines complex problems in accounting and reporting; examples include pensions, taxes, interest rate swaps, derivative securities, international transactions, and international financial reporting. Takes a user-oriented perspective, and examines the ways in which financial accounting information is used by investors, analysts, and creditors. Examples include if users adjust for alternative accounting methods or for information that is recognized versus disclosed.

BUSM 750 Project Management in Dynamic Environments (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI785 or BUSM750.
Addresses project management skills that are required by successful managers in increasingly competitive and faster-moving environments. Examines fundamental concepts of successful project management, and the technical and managerial issues, methods, and techniques.

BUSM 752 Games of Strategy and Incentives (4 credits)
Prerequisite: Permission of BMGT-Robert H. Smith School of Business. Or BUSM610; and BUSM604; and BUSM614. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business.
Analysis of managerial decisions in strategic environments using tools from game theory; competition and cooperation in product markets; principal-agent model and the economics of incentives; analytical foundations of behavioral constructs such as reputation, commitment and credibility.

BUSM 754 Competitive and Collaborative Negotiation (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMO714 or BUSM754.
Increase negotiating self-confidence and improve capacity to achieve win-win solutions to organizational problems. Improve effectiveness at finding creative solutions to conflict.

BUSM 755 Organizational Change (2 credits)
Prerequisite: BUSM600. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business.
Develops the advanced knowledge and skills of MBA students who plan to work with organizations as change agents. Concrete and useful strategies, tools, and interventions for diagnosing organizational change situations, analyzing problems, and designing and implementing organizational change. Draws on literature from organizational behavior, human resource management and strategic management to identify models as prescriptions of change.

BUSM 757 Implementing Strategy: Organizing to Compete (2 credits)
Prerequisite: BUSM614. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMO751 or BUSM757.
Organizational dynamics of competitive advantage. Impact of alternative organizational structures, planning and control systems, human resource management practices, and executive leadership styles on the implementation of archetypically different strategies.

BUSM 761 Data Mining and Predictive Analytics (2 credits)
Prerequisite: BUSM606. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUDT733 or BUSM761. Formerly: BUDT733.
Data mining techniques and their use in business decision making. A hands-on course that provides an understanding of the key methods of data visualization, exploration, classification, prediction, time series forecasting, and clustering.

BUSM 762 Decision Analytics (2 credits)
Prerequisite: BUSM606. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUDT732 or BUSM762.
Analytical modeling for managerial decisions using a spreadsheet environment. Includes linear and nonlinear optimization models, decision making under uncertainty and simulation models.

BUSM 764 Pricing and Revenue Management (2 credits)
Prerequisite: BUSM606; and BUSM624. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUDT775 or BUSM764.
Specialized course on pricing and revenue management (PRM) that provide students with tools and principles, drawn from several disciplines (Operations, Microeconomics, Decision Modeling, Statistics, Marketing, IS) to make effective pricing decisions. Topics covered include economics of pricing, strategy and tactics of PRM, pricing optimization, differentiated pricing, dynamic pricing, mark-down pricing, legal and ethical issues in models/methods used in making effective PRM decisions and managerial or organizational factors that hold the key to success in execution of PRM.

BUSM 765 Social Media and Web 2.0 (2 credits)
Prerequisite: BUSM621; or BUSM622. Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUDT706 or BUSM765.

Over the past years, social computing technologies such as online communities, blogs, wikis, and social networking systems have become important tools for individuals to seek information, socialize with others, get support, collaborate on work, and express themselves. Increasingly, businesses are trying to leverage web 2.0 by using social computing technologies to communicate with customers, employees, and other business partners or to build new business models. This course will review concepts and principles related to web 2.0 and examine issues and strategies associated with business use of social computing technologies.

BUSM 773 Innovation & Entrepreneurship (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMO732 or BUSM773.
Provides an introduction to important tools and skills necessary to create and grow a successful new venture. Integrates research findings from a range of different practical and intellectual perspectives, including psychology, sociology, economics, strategic management, and history into practical, hands on lessons for an entrepreneur. Class projects provide the foundations for new, real businesses.

BUSM 775 Global Strategy (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUMO754 or BUSM775.
Focuses on the "strategic" and "organizational" questions that a company must address as it globalizes its footprint. Among the questions that will be addressed are: What are the potential benefits, costs, and risks associated with going abroad? What differentiates a "global" from a "multidomestic" industry? What are the sources of competitive advantage in a global context?

BUSM 778 Introduction to Global Business Experience (1-4 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Repeatable to 4 credits. Credit only granted for: BUSI788 or BUSM778.
Introduction to the economic climate of the country and region, history political influences on business landscape, and specific opportunities and threats of doing business in the destination country. Course is a prerequisite to short-term study abroad classes.

BUSM 783 Global Supply Chain Management (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BUSI672 or BUSM783.
Offers a practical blueprint for understanding, building, implementing, and sustaining supply chains in today's rapidly changing global supply chain environment. It will provide the student with a survey of the fast-moving Supply Chain Management discipline and practice, including the evolution of supply chain strategies, business models and technologies; current best practices in demand and supply management; and methodologies for conducting supply chain-wide diagnostic assessments and formulating process improvement plans.

BUSM 784 Assessing and Managing Supply Chain Risks (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BULM734 or BUSM784.
Supply chain managers are facing an increasingly volatile operating environment, with constant danger of trading community disruption from business, social and environmental risks. Students are provided with a working knowledge of both the core techniques of supply chain risk assessment and mitigation; as well as best practices in establishing formal corporate supply chain risk management programs. A semester-long X-Treme Supply Chain Simulation will enable students to gain hands-on experience in navigating a computer company through a complex and risky four quarters of global business operations.

BUSM 785 Global Supply Chain Resources Planning (2 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Credit only granted for: BULM742 or BUSM785.
Provides students with an overall understanding of how firms use an advanced supply chain planning (ASCP) application as an integral part of their materials management process which includes such activities as production planning, materials requirements planning, and distribution requirements planning.

BUSM 788 Global Business Experience (1-6 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Repeatable to 8 credits if content differs.
Provides MBA students the opportunity to combine classroom learning and project research with seminars in a host country. The focus and locations visited will vary.

BUSM 798 Business Consulting (1-4 credits)
Restriction: Must be in Business and Management (Master's) program; or permission of BMGT-Robert H. Smith School of Business. Repeatable to 8 credits if content differs. Credit only granted for: BUSM798 or BMGT798.
Selected advanced topics in the various fields of graduate study in business.

Cell Biology and Molecular Genetics (CBMG)

CBMG 688 Special Topics in Cell Biology and Molecular Genetics (1-4 credits)
Formerly: MICB688.
Presentation and discussion of fundamental problems and special subjects in the topics of Cell Biology and Molecular Genetics.

CBMG 699 Special Problems in Cell Biology and Molecular Genetics (1-3 credits)
Repeatable to 10 credits if content differs. Formerly: PBIO699.
Emphasis is placed on research and discussion of current problems in the area of Cell Biology and Molecular Genetics.

CBMG 789 Seminar in Cell Biology and Molecular Genetics (2 credits)
Repeatable to 4 credits if content differs. Formerly: MICB789.
Cell Biology and Molecular Genetics Department Seminar.

CBMG 799 Masters Thesis Research (1-6 credits)
Master's Thesis Research in Cell Biology and Molecular Genetics.

CBMG 898 Pre-Candidacy Research (1-8 credits)
Pre-candidacy Research.

CBMG 899 Doctoral Dissertation Research (1-8 credits)
Doctoral Dissertation Research.

Criminology and Criminal Justice (CCJS)

CCJS 400 Criminal Courts (3 credits)
Prerequisite: CCJS100 and CCJS300; or permission of BSOS-Criminology &

Criminal Justice department.
Criminal courts in the United States at all levels; judges, prosecutors, defenders, clerks, court administrators, and the nature of their jobs; problems facing courts and prosecutors today and problems of administration; reforms.

CCJS 418 Seminar in Criminology and Criminal Justice (3 credits)
Repeatable to 18 credits if content differs.
Selected topics of interest in the field of Criminology and Criminal Justice will be covered.

CCJS 432 Law of Corrections (3 credits)
Prerequisite: CCJS100, CCJS105, CCJS230, and CCJS300.
A review of the law of criminal corrections from sentencing to final release or release on parole. Probation, punishments, special treatments for special offenders, parole and pardon, and the prisoner's civil rights are also examined.

CCJS 440 Security Administration (3 credits)
Prerequisite: CCJS100 and CCJS340. Credit only granted for: CCJS440 or CCJS498Z. Formerly: CCJS498Z.
Designed to introduce students to the complex issues of Security Administration and the critical terrorism issues facing the nation. Emphasis is placed on understanding the historical and contemporary issues effecting U.S. Counterterrorism Policy. It also explores the challenges facing today's security administrators including: ethics, classified information, intelligence, terrorist organizations and incidents, physical and personnel security, transportation and border security issues.

CCJS 444 Advanced Law Enforcement Administration (3 credits)
Prerequisite: CCJS100 and CCJS340.
The structuring of manpower, material, and systems to accomplish the major goals of social control. Personnel and systems management. Political controls and limitations on authority and jurisdiction.

CCJS 450 Advanced Juvenile Delinquency (3 credits)
Prerequisite: CCJS105 and CCJS300. Credit only granted for: CCJS350 or CCJS450.
Examination of juvenile delinquency in the United States. Nature and extent of juvenile delinquency, historical approaches, sociological and criminological theories and research, social contexts including the institutions of families, schools, and peers, and social responses. Prevention, punishment, and treatment programs, both within and outside of the juvenile justice and criminal justice systems.

CCJS 451 Crime and Delinquency Prevention (3 credits)
Prerequisite: CCJS105 and CCJS300.
Methods and programs in prevention of crime and delinquency.

CCJS 452 Treatment of Criminals and Delinquents (3 credits)
Prerequisite: CCJS105 and CCJS300. Credit only granted for: CCJS 342 or CCJS 452.
Processes and methods used to modify criminal and delinquent behavior.

CCJS 453 White Collar and Organized Crime (3 credits)
Prerequisite: CCJS300; and (CCJS350 or CCJS105).
Definition, detection, prosecution, sentencing and impact of white collar and organized crime. Special consideration given to the role of federal law and enforcement practices.

CCJS 454 Contemporary Criminological Theory (3 credits)
Prerequisite: CCJS300 and CCJS105.
Examination of the main theoretical accounts that explain the underlying causes of criminal behaviors. Explore how individual choices, socialization experiences, biological factors and social structure affect criminal behaviors.

CCJS 455 Dynamics of Planned Change in Criminal Justice I (3 credits)
Prerequisite: CCJS300. Restriction: Permission of BSOS-Criminology & Criminal Justice department.
An examination of conceptual and practical issues related to planned change in criminal justice. Emphasis on the development of innovative ideas using a research and development approach to change.

CCJS 456 Dynamics of Planned Change in Criminal Justice II (3 credits)
Prerequisite: CCJS455; or permission of BSOS-Criminology & Criminal Justice department.
An examination of conceptual and practical issues related to planned change in criminal justice. Emphasis on change strategies and tactics which are appropriate for criminal justice personnel in entry level positions.

CCJS 457 Comparative Criminology and Criminal Justice (3 credits)
Prerequisite: CCJS300; and (CCJS350 or CCJS105).
Comparison of law and criminal justice systems in different countries. Special emphasis on the methods of comparative legal analysis, international cooperation in criminal justice, and crime and development.

CCJS 458 Special Topics in Study Abroad IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

CCJS 461 Psychology of Criminal Behavior (3 credits)
Prerequisite: CCJS105; or students who have taken courses with comparable content may contact the department. And CCJS300.
Biological, environmental, and personality factors which influence criminal behaviors. Biophysiology and crime, stress and crime, maladjustment patterns, psychoses, personality disorders, aggression and violent crime, sex-motivated crime and sexual deviations, alcohol and drug abuse, and criminal behavior.

CCJS 489 Honors Thesis Research (3 credits)
Prerequisite: CCJS100 and CCJS105. Restriction: Limited to CCJS Departmental Honors students.
Designed for students completing their honors thesis.

CCJS 498 Selected Topics in Criminology and Criminal Justice (3 credits)
Repeatable to 6 credits if content differs.
Topics of special interest to advanced undergraduates in criminology and criminal justice. Offered in response to student request and faculty interest.

CCJS 600 Criminal Justice (3 credits)
Restriction: Must be in one of the following programs (Criminology and Criminal Justice (Master's); Criminology and Criminal Justice (Doctoral)) ; or permission of BSOS-Criminology & Criminal Justice department. Formerly: CJUS600.
Current concept of criminal justice in relationship to other concepts in the field. Historical perspective. Criminal justice and social control. Operational implications. Systemic aspects. Issues of evaluation.

CCJS 601 Policing (3 credits)
An introduction to research, theory, and applications of the causes and consequences of police behavior. Community policing, problem-solving methods, police discretion, police

misconduct, police crime prevention strategies, and restorative justice.

CCJS 602 Courts and Sentencing (3 credits)

Research and theory on prosecution, plea-bargaining, sentencing principles and guidelines, and sentencing policies in practice. Mandatory minimum sentencing, "three strikes" laws, race, gender and class disparities, general and specific deterrent effects of sentencing, restitution and restorative justice, diversion and sentencing to treatment.

CCJS 603 Corrections (3 credits)

An introduction to the research and policy issues for community-based and institutional correctional programs, assessment and screening tools, management of convicted offenders and institutional overcrowding. Research on prediction of recidivism, matching of treatment programs to offenders, management of correctional institutions and programs.

CCJS 604 Policy Analysis Project (3 credits)

An application of statistical and conceptual tools to criminal justice data in the student's area of concentration, resulting in a paper reporting the conceptualization, analytic methods and results. The topic of the independent study will be chosen through individual consultation with the instructor.

CCJS 605 Program Evaluation for Criminal Justice (3 credits)

Credit only granted for: CCJS605 or CCJS609. Formerly: CCJS609.

Designing, implementing and evaluating programs in criminal justice. Topics include diagnosing program needs, planning and tailoring evaluation programs, program monitoring, assessing program impact, program efficiency, and the social context of evaluation.

CCJS 610 Research Methods in Criminal Justice and Criminology (3 credits)

Formerly: CRIM610.

Examination of special research problems and techniques.

CCJS 611 Statistical Tools for Criminal Justice (3 credits)

An introduction to essential statistical concepts for analyzing crime and evaluating criminal justice policies. Interpreting crime trends and correlations, risk and conditional probability analysis for repeat offenders and hot spots of crime, time series analysis, experimental statistics, effect sizes, statistical power and significance.

CCJS 620 Fundamentals of Criminological Research (3 credits)

Credit only granted for: CCJS498D or CCJS620. Formerly: CCJS498D.

Designed to help criminology students understand and apply three important components of statistics: decriptive statistics (including probability theory), fundamentals of statistical inference, and regression analysis. Course assumes familiarity with basic descriptive statistics. The emphasis of the classes on descriptive statistics is the calculation and interpretation of summary statistical measures for describing raw data. Covers the basic rules of probability and different probabilistic processes that could describe criminal activity. The sessions on fundamentals of statistical inferences are designed to provide background for executing and interpreting hypothesis tests and confidence intervals. The latter portion of the course focuses on regession analysis. Uses the statistical software, Stata.

CCJS 635 Minorities and Criminal Justice (3 credits)

Prerequisite: CCJS600; or students who have taken courses with comparable content may contact the department.

Role minorities play in the criminal justice system: as victims, offenders and professionals. Also provides theoretical framework for examining these roles.

CCJS 651 Seminar in Criminology (3 credits)

Formerly: CRIM651.

Analysis of significant recent issues in Criminology.

CCJS 652 Seminar in Juvenile Delinquency (3 credits)

Formerly: CRIM652.

Analysis of delinquency and its control.

CCJS 653 Seminar in Corrections (3 credits)

Prerequisite: CCJS651; or students who have taken courses with comparable content may contact the department. Formerly: CRIM653.

Development, operation and future of correctional systems.

CCJS 654 History of Criminological Thought (3 credits)

Prerequisite: CCJS454; or students who have taken courses with comparable content may contact the department. Formerly: CRIM654.

A study of the development of criminological thought from antiquity to the present.

CCJS 657 Comparative Criminology and Criminal Justice Systems (3 credits)

A cross national examination of the meaning of criminality, formal and informal responses to crime, and the internalization of crime and criminal justice.

CCJS 660 Gender and Crime (3 credits)

Assumptions, biases, and relative strengths and weaknesses of theories of crime as applied to women. Criminal justice sanctioning of crimes by and against women. The course will also explore occupational segregationby gender in criminal justice professions, particularly in the fields ofpolicing, courts (attorneys and judges), and corrections (correctionalofficers and treatment staff).

CCJS 661 Crime and the Life Course (3 credits)

Credit only granted for: CCJS699J or CCJS661. Formerly: CCJS699J.

Designed to provide an intensive examination of crime and the life course. Life course is examined as a theoretical orientation, a research methodology, and an empirical field of study with special reference to crime and deviance. Course includes development of criminal behavior and criminal careers; stability and change in criminal behavior across developmental stages; trajectories, transitions, and turning points through life; quantitative and qualitative approaches to studying crime and the life course; and social change and its link to individual lives.

CCJS 662 Psychology of Crime and Justice (3 credits)

Credit only granted for: CCJS699P or CCJS662. Formerly: CCJS699P.

A seminar designed to increase knowledge of the criminal behavior of adults and juveniles and what can be done to change this behavior. Students will be expected to develop a thorough understanding of the history, development, operation, effectiveness, and future of formal efforts to understand and control criminal behavior.

CCJS 663 Issues in Corporate Crime (3 credits)

Credit only granted for: CCJS699S or CCJS663. Formerly: CCJS699S.

Overview of what is known about corporate crime and criminals (e.g.: similarities to and differences from other offenders and crime types; characteristics of offenders and victims; what counts as corporate crime ; introduction to theoretical frameworks.) Readings and class materials will coalesce around specific issues about which there is much debate but scant empirical research. Discussions will center around what is known, what is not, what needs to be done and how.

CCJS 664 Regulating Vice and Regulating Organized Crime (3 credits)
Credit only granted for: CCJS699V or CCJS664. Formerly: CCJS699V.
For this course, vice is defined as a habit with bad consequences that can generate large black markets if the market for supplying that habit is prohibited or heavily regulated. Vice if found in all modern societies, though in widely differing forms, depending on population characteristics, culture and law. Society's decision is how to regulate it, whether criminally or otherwise, and how then to assess whether the regulation is successful. This assessment has multiple components, including: choosing outcome measures; modeling counterfactuals for which the evidence is often very indirect and developing a framework for ensuring that comparisons reflect all relevant outcomes and values.

CCJS 665 Professional Development (3 credits)
Credit only granted for: CCJS699D or CCJS665. Formerly: CCJS699D.
A seminar designed for students who are planning to complete their Ph.D. in Criminology and Criminal Justice. Focus on issues important to consider during one's career. Discussions and activities will include topics such as: planning one's graduate career, resumes, planning a professional career, employment opportunities, interviewing for jobs, teaching, publishing and reviewing manuscripts, grants and proposals, research, achieving tenure.

CCJS 667 Innovations in Policing: Programs, Policies and Research (3 credits)
Credit only granted for: CCJS667 or CCJS699W. Formerly: CCJS699W.
Examine the factors that have led to recent police innovations and recent innovations in the study of policing. Critically explores the effects of such policies on crime and disorder, on research practices, as well as unintended consequences on community, police abuse and police organization. Which policies have been found to be effective? What types of practices work most effectively for what type of crime and disorder problems? Has there been sufficient research for us to come to solid conclusions regarding these questions? Does present research fit the practices of the police?

CCJS 670 Race, Crime, and Criminal Justice (3 credits)
Provides an historical overview of the operation and evolution of the criminal justice system and the impact of race. How race affects definitions of crime and criminality, the workings of the criminal justice system, the development of criminological theory, and the role of criminal justice ethics in the study of race and crime will be considered.

CCJS 678 Advanced Topics in Criminology and Criminal Justice (3 credits)
Prerequisite: CCJS600. Repeatable to 12 credits if content differs.
An analysis of contemporary issues in criminology and criminal justice with special emphasis on research and theory developments.

CCJS 680 Drugs and Crime (3 credits)
The relationship between drug use and crime. Policy concerning drug control enforcement, prosecution and sentencing. impact of drug treatment in criminal justice Impact of drug treatment in criminal justice settings, drug courts, drug-testing strategies and surveillance of former drug abusers in the community.

CCJS 699 Special Criminological Problems (1-3 credits)
Restriction: Permission of BSOS-Criminology & Criminal Justice department. Repeatable to 6 credits. Formerly: CJUS699.
Supervised study of a selected problem in the field of criminal justice.

CCJS 700 Advanced Research Methods in Criminology and Criminal Justice (3 credits)
Prerequisite: CCJS610.
An in-depth inventory of the methods of criminological research. It considers the philosophy of science and research ethics; discusses sampling, measurement and methods of data collection, including survey, experimental, evaluation, and qualitative research.

CCJS 710 Advanced Statistics Methods - Limited Dependent Variables (3 credits)
Prerequisite: Must have completed an approved doctoral level statistics course. Formerly: CRIM710.
Application of advanced data analysis strategies to criminological and criminal justice problems, with specific focus on limited dependent variables.

CCJS 711 Randomized Experiments in Criminology and Criminal Justice (3 credits)
Constrast randomized designs with other approaches, examining both statistical, methodological, ethical and practical concerns. What are the statistical advantages of randomized experimental designs? Why do some researchers believe that randomized studies violate ethical standards in criminal justice? Why are experiments considered to have higher internal validity than non-randomized designs and how do different types of designs compare in terms of external validity? Focus on how experiments can be developed and how they are analyzed. What are the practical barriers to experimentation and how can they be overcome? What statistical methods are most appropriate for experimental analysis? How can block randomization or hierarchical modeling be used to develop more powerful or more practical research approaches?

CCJS 712 Longitudinal Data Analysis with Latent Variables (3 credits)
Credit only granted for: CCJS699F or CCJS712. Formerly: CCJS699F.
This course is designed for graduate students with an interest in the use of latent variables in longitudinal data analysis as it is conceptualized in the Mplus framework. This course explores more general features of latent variable analyses as they are related to longitudinal modeling. Topics to be covered include latent growth analysis with a combination of continuous and categorical latent variables as well as the inclusion of continuous and categorical variables as predictors and outcomes.

CCJS 720 Criminal Justice System Planning: Policy Analysis for Crime Control (3 credits)
Prerequisite: Must have completed 1 course in research methodology; and 1 course in CCJS. Formerly: CJUS720.
System theory and method; examination of planning methods and models based primarily on a systems approach to the operations of the criminal justice system.

CCJS 799 Master's Thesis Research (1-6 credits)
Formerly: CRIM799.

CCJS 898 Pre-Candidacy Research (1-8 credits)

CCJS 899 Doctoral Dissertation Research (1-8 credits)
Formerly: CRIM899.
Doctoral dissertation research in criminal justice and criminology.

Chemical and Biomolecular Engineering (CHBE)

CHBE 410 Statistics and Design of Experiments (3 credits)
Prerequisite: Minimum grade of C- in CHBE250, MATH241, and MATH246. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE410 or

ENCH476. Formerly: ENCH476.
An introduction to probability, statistics, and design of experiments for chemical engineers.

CHBE 422 Chemical and Biomolecular Engineering Transport Phenomena I (3 credits)

Prerequisite: Minimum grade of C- in CHBE101, CHBE250, MATH241, and MATH246. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE422 or ENCH422. Formerly: ENCH422.
Principals of fluid dynamics as applied to model development and process design. Mass, momentum and energy conservation. Statics and surface tension. Equation of Continuity and Navier-Stokes Equation with application to laminar flow. Dimensional analysis. Macroscopic balances, Bernoulli Equation and friction factors with application to turbulent flow.

CHBE 424 Chemical and Biomolecular Engineering Transport Phenomena II (3 credits)

Prerequisite: CHBE422. Corequisite: CHBE302. Restriction: Must be in Engineering: Chemical program; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE424 or ENCH424. Formerly: ENCH424.
Principles of mass and heat transfer as applied to model development and process design. Species continuity equation with application to diffusion, and convection in laminar flow. Macroscopic balances and mass transfer coefficients with application to turbulent flow. Microscopic equation of energy with application to heat conduction, and convection in laminar flow. Macroscopic energy balance and heat transfer coefficients with application to turbulent flow. Heat exchanger design.

CHBE 426 Chemical and Biomolecular Separation Processes (3 credits)

Corequisite: CHBE302; and CHBE424. Restriction: Must be in Engineering: Chemical program; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE426 or ENCH426. Formerly: ENCH426.
Separation by stages operations. Rate dependent separation processes. Design application in distillation, gas absorption, liquid extraction, drying, adsorption and ion exhange.

CHBE 437 Chemical and Biomolecular Engineering Laboratory (3 credits)

Prerequisite: CHBE424, CHBE426, and CHBE440. Restriction: Must be in a major within ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE437 or ENCH437. Formerly: ENCH437.
Application of chemical engineering process and unit operation principals in small-scale semi-commercial equipment. Data from experimental observations are used to evaluate performance and efficiency of operations. Emphasis on correct presentation of results inreport form.

CHBE 440 Chemical Kinetics and Reactor Design (3 credits)

Prerequisite: Minimum grade of C- in CHBE301, MATH241, and MATH246. Restriction: Must be in Engineering: Chemical program; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE440 or ENCH440. Formerly: ENCH440.
Fundamentals of chemical reaction kinetics and their application to the design and operation of chemical reactors. Reaction rate theory, homogeneous reactions and catalysis electrochemical reactions. Catalytic reactor design.

CHBE 442 Chemical and Biomolecular Systems Analysis (3 credits)

Prerequisite: CHBE424 and CHBE426. Credit only granted for: CHBE442 or ENCH442. Formerly: ENCH442.
Dynamic response applied to process systems. Goals and modes of control, Laplace transformations, analysis and synthesis of simple control systems, closed loop response, dynamic testing.

CHBE 444 Process Engineering Economics and Design I (3 credits)

Prerequisite: CHBE424, CHBE426, and CHBE440. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE444 or ENCH444. Formerly: ENCH444.
Principles of chemical engineering economics and process design. Equipment sizing and costing. Economic evaluation of projects. Flowsheet synthesis. Introduction to flowsheet simulators and concepts of flowsheet optimization. Synthesis of Heat Exchanger Networks and Distillation Sequences.

CHBE 446 Process Engineering Economics and Design II (3 credits)

Prerequisite: CHBE442 and CHBE444. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE446 or ENCH446. Formerly: ENCH446.
Application of chemical engineering principles for the design of chemical processing equipment. Representative problems in the design of chemical plants will be the focus of this capstone design class. Comprehensive reports are required.

CHBE 451 Photovoltaics: Solar Energy (3 credits)

Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: ENCH468L or CHBE451. Formerly: ENCH468L.
The emphasis of the class is on developing a conceptual understanding of the device physics and manufacturing processes of crystalline and thin-film photovoltaic cells, and to develop elementary computational skills necessary to quantify solar cell efficiency. The class material includes detailed, system-level energy balances necessary to understand how solar energy fits into the complete energy generation, conversion, and storage picture. Quantitative comparisons of PV technology to solar chemical conversion processes and biofuels are made.

CHBE 453 Applied Mathematics and Distributive Parameter Systems (3 credits)

Credit only granted for: CHBE453 or ENCH453. Formerly: ENCH453.
Mathematical techniques applied to the analysis and solution of chemical engineering problems. Use of differentiation, integration, differential equations, partial differential equations and integral transforms. Application of infinite series, numerical and statistical methods.

CHBE 454 Chemical Process Analysis and Optimization (3 credits)

Credit only granted for: CHBE454 or ENCH454. Formerly: ENCH454.
Application of mathematical models to the analysis and optimization of chemical processes. Models based on transport, chemical kinetics and other chemical engineering principles will be employed.

CHBE 455 Model Predictive Control (3 credits)

Credit only granted for: CHBE455 or ENCH455. Formerly: ENCH455.
Empirical model identification from process data. Step and impulse response models. Linearization of nonlinear first principles models. Single variable Model Predictive Control. Robustness with respect to modeling error. MPC based tuning of PID controllers. Feedforward control. Multi-input multi-output processes.

Multi-loop decentralized control. Centralized multivariable Model Predictive Control via on-line optimization.

CHBE 468 Research (1-3 credits)

Restriction: Permission of instructor. Repeatable to 6 credits. Formerly: ENCH468.

Investigation of a research project under the direction of a faculty member. Comprehensive reports are required.

CHBE 470 The Science and Technology of Colloidal Systems (3 credits)

Prerequisite: CHBE424, CHBE426, and CHEM482. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE470 or ENCH470. Formerly: ENCH470.

Introduction to colloidal systems. Preparation, stability and coagulation kinetics of colloidal suspensions. Introduction to DLVO theory, electrokinetic phenomena, rheology of dispersions, surface/interfacial tension, solute absorption at gas-liquid, liquid-liquid, liquid-solid and gas-solid interfaces and properties of micelles and other microsturctures.

CHBE 471 Particle Science and Technology (3 credits)

Prerequisite: Knowledge of undergraduate engineering thermodynamics, and transport phenomena; knowledge of numerical methods for solving systems of ordinary differential equations. Restriction: Must be in a major within ENGR-Chemical & Biomolecular Engineering department; or permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE471 or ENCH471. Formerly: ENCH471.

Particles are everywhere. We breathe them, eat them, and use them to make many non-particulate materials. Knowledge of particle science and technology is important for manufacturing, for occupational health and safety, as well as environmental considerations. In this multidisciplinary course, the focus will be on the study of science and technology relevant to multiphase systems consisting of solid and/or liquid particles surrounded by a gas. These topics fall loosely under the headings of powder and aerosol technology. Team design projects will be an integral component.

CHBE 472 Control of Air Pollution Sources (3 credits)

Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department.

Sources and effects of air pollutants, regulatory trends, atmospheric dispersion models, fundamentals of two-phase flow as applied to air pollution and air pollution control systems, design of systems for control of gases and particulate matter.

CHBE 473 Electrochemical Energy Engineering (3 credits)

Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: ENCH468K or CHBE473. Formerly: ENCH468K.

The lecture will start from the basic electrochemical thermodynamics and kinetics, with emphasis on electrochemical techniques, fundamental principle and performance of batteries, and supercapacitors.

CHBE 475 Ethics in Science and Engineering (3 credits)

Credit only granted for: CHBE475 or ENCH475. Formerly: ENCH475.

Ethical issues in science and engineering and their resolutions are examined. The main topics will be ethics and scientific truth (including issues of proper data analysis, proper data presentation, and record-keeping), ethics and other scientists and engineers (including issues of attribution, confidentiality, conflicts of interest, mentoring, and inclusion of under-represented groups), ethics and the practice of engineering (including responsibilities of engineers to clients, ecological issues, and conflicts of interest), and ethics and society (including funding priorities, moral issues, and human and animal subjects). Class meetings will be organized around discussions, case studies, and student reports. The course is aimed at postdoctoral students, graduate students and advanced undergraduate students who wish to ponder the important contemporary questions about the ethics of how science and engineering get done.

CHBE 476 Molecular Modeling Methods (3 credits)

Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: ENCH468P or CHBE476. Formerly: ENCH468P.

Statistical mechanics will be introduced to give the fundamental background for atomic to mesoscale molecular modeling. Classical atomic-level simulations methods (Monte Carlo and Molecular Dynamics) and the procedures to develop intra- and intermolecular potentials will be covered. This course will also discuss the theory and application of coarse-grained molecular simulations, mesoscale simulations and other modern simulation techniques. A broad range of applications will be included throughout the semester, e.g., phase behavior of small molecules, kinetics, and biophysics.

CHBE 477 Mesoscopic and Nanoscale Thermodynamics (3 credits)

Prerequisite: A prior course in classical thermodynamics. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE477 or ENCH468Q. Formerly: ENCH468Q.

Interdisciplinary course primarily for graduate and senior undergraduate students from engineering or science departments. New emerging technologies deal with bio-membrane and gene engineering, microreactor chemistry and microcapsule drug delivery, micro-fluids and porous media, nanoparticles and nanostructures, supercritical fluid extraction and artifical organs. Engineers often design processes where classical thermodynamics may be insufficient, e.g., strongly fluctuating and nanoscale systems, or dissipative systems under conditions far away from equilibrium.

CHBE 480 Bionanotechnology: Physical Principles (3 credits)

Prerequisite: BIOE120 or BSCI105. And BCHM461; or students who have taken courses with comparable content may contact the department. Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department.

Physics at nano/micro scales. Biomolecular building blocks. Simplest biomolecular assembly: protein folding. Nanoscale intermolecular interactions important for biology. Protein-ligand binding. Protein higher-order assembly: filaments, networks. Protein filaments and motility. DNA, RNA and their assembly assisted by proteins. Viral capsid assembly. Lipid assembly into micelles, bilayers. Lipid-protein co-assembly in membranes. Lipid and polymer structures useful in medicine. Targeted delivery of drugs, genes by nano/micro structures. Cellular assembly in the eye, in insect wings. Cellular assembly at surfaces: gecko feet, duck feathers. Cellular assembly in the presence of crystals: biomineralization.

CHBE 481 Transport Phenomena in Small and Biological Systems (3 credits)

Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: ENCH468W or CHBE481. Formerly: ENCH468W.

Interdisciplinary course primarily for senior undergraduate and graduate students from engineering or science departments. The course's main goal is to make the students familiar with the fundamental physics and modeling of transport phenomena in small and biological systems, and their current scientific and engineering utilization in microfluidics, nanofluidics and biological systems.

CHBE 482 Biochemical Engineering (3 credits)

Prerequisite: CHBE440. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE482 or ENCH482. Formerly: ENCH482.
Introduction to biochemical and microbiological applications to commericail and engineering processes, including industrial fermentation, enzymology, ultrafiltration, food and pharmaceutical processing and resulting waste treatment. Enzyme kinetics, cell growth, energetics and mass transfer.

CHBE 483 Bioseparations (3 credits)
Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: ENCH483 or CHBE483. Formerly: ENCH483.
Engineering fundamentals of separations and purification of biological molecules. Case studies and examples illustrate principles and practice of centrifugation, precipitation, crystallization, filtration, membrane separations, chromatography, and affinity separation of recombinant proteins and other biomolecules. Process scale-up and economics of biotechnology products and processes.

CHBE 484 Metabolic Pathway Engineering (3 credits)
Prerequisite: CHBE101 and CHBE440. Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: ENCH468M or CHBE484. Formerly: ENCH468M.
The state-of-the-art in metabolic engineering, with a focus on the analysis and engineering of metabolic pathways through (chemical) engineering principles, will be covered. Topics covered include: (1) overview of biochemistry and metabolism; (2) metabolic flux analysis and isotope labeling illustrated with examples from the recent scientific literature; (3) technologies for engineering metabolic pathways; (4) metabolic control analysis and pathway regulation; (5) applications of metabolic engineering to synthesis of biofuels and therapeutics; (6) specialized and related subjects such as protein engineering and synthetic biology.

CHBE 485 Biochemical Engineering Laboratory (3 credits)
Credit only granted for: CHBE485 or ENCH485. Formerly: ENCH485.
Techniques of measuring pertinent parameters in fermentation reactors, quantification of production variables for primary and secondary metabolites such as enzymes and antibiotics, the insolubilization of enzymes for reactors, and the demonstration of separation techniques such as ultrafiltration and affinity chromatography.

CHBE 486 Heterogeneous Catalysis for Energy Applications (3 credits)
Prerequisite: Minimum grade of C- in CHBE302, CHBE424, and CHBE440; and permission of instructor. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department. Credit only granted for: CHBE486 or ENCH686.
Introduction to heterogeneous catalytic science and technology for energy conversion and hydocarbon processing. Preparation and mechanistic characterization of catalyst systems, kinetics of catalyzed reactions, adsorption and diffusion influences in heterogenious reactions. An overview of heterogeneous catalysis in various energy-related applications, including petroleum refining, chemicals from biomass, valorization of shale gas, and CO2 utilization will be introduced.

CHBE 487 Tissue Engineering (3 credits)
Prerequisite: Must have completed at least one biology course; and MATH241. Recommended: BSCI330 and BIOE340. Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; or permission of ENGR-Chemical & Biomolecular Engineering department. Also offered as: BIOE411. Credit only granted for: BIOE411, CHBE487, or ENCH468T. Formerly: ENCH468T.
A review of the fundamental principles involved in the design of engineered tissues and organs. Both biological and engineering fundamentals will be considered.

CHBE 490 Polymer Science (3 credits)
Also offered as: ENMA495. Credit only granted for: CHBE490, ENCH490, or ENMA495. Formerly: ENCH490.
The elements of the polymer chemistry and industrial polymerization, polymer structures and physics, thermodynamics of polymer solutions, polymer processing methods, and engineering applications of polymers.

CHBE 495 Nanoparticle Aerosol Dynamics and Particle Technology (3 credits)
Restriction: Must be in a major within the ENGR-Chemical & Biomolecular Engineering department; and permission of ENGR-Chemical & Biomolecular Engineering department.
NanoParticles (NA) (< 100 nm), and their science and technology play an important role in nature and industry. From air quality standards, nuclear reactor safety, inhalation therapy, workplace exposure, global climate change, to counterterrorism, aerosols play a central role in our environment. On the industrial side, NA plays an integral part of reinforcing fillers, pigments and catalysts, and the new emerging field of nanotechnology, they are the building blocks to new materials, which encompass, electronic, photonic and magnetic devices, and bio and chemical sensors.

CHBE 496 Processing and Engineering of Polymers (3 credits)
Credit only granted for: CHBE496 or ENCH496. Formerly: ENCH496.
A comprehensive analysis of processing and engineering techniques for the conversion of polymeric materials into useful products. Evaluation of the performance of polymer processes, design of polymer processing equipment.

Chemistry (CHEM)

CHEM 401 Inorganic Chemistry (3 credits)
Prerequisite: CHEM276 or CHEM271; and (CHEM247 or CHEM241).
An overview of basic concepts of the electronic structure of the elements, chemical bonding and reactivity, from simple diatomic molecules to coordination compounds. These are viewed from simple (Lewis) to the most comprehensive molecular orbital theory. Symmetry and group theory are used throughout the course.

CHEM 403 Radiochemistry (3 credits)
Prerequisite: Must have completed one year of college chemistry and one year of college physics.
Radioactive decay; introduction to properties of atomic nuclei; nuclear processes in cosmology; chemical, biomedical and environmental applications of radioactivity; nuclear processes as chemical tools; interaction of radiation with matter.

CHEM 425 Instrumental Methods of Analysis (4 credits)
Prerequisite: CHEM272 and CHEM271; or (CHEM276 and CHEM277).
Modern instrumentation in analytical chemistry. Electronics, spectroscopy, chromatography and electrochemistry.

CHEM 441 Advanced Organic Chemistry (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in CHEM481; and 1 course with a minimum grade of C- from (CHEM241, CHEM247). Also offered as: CHEM641.
An advanced study of the compounds of carbon, with special emphasis on molecular orbital theory and organic reaction mechanisms.

CHEM 460 Structure Determination Using Spectroscopic Methods (3 credits)
Prerequisite: Must have completed CHEM243; or CHEM247; or (CHEM241 and CHEM242). Formerly: CHEM660.
The use of infrared, ultraviolet-visible, proton and carbon-13 nuclear magnetic resonance and mass spectroscopy for structure determination in organic chemistry.

CHEM 471 Techniques in Pulse NMR (1 credits)
Prerequisite: CHEM241 and CHEM242; or CHEM247. Recommended: CHEM460. Restriction: Senior standing or higher. Additional information: Persons with heart pacemakers and/or metal implants cannot take the course due to potential health hazards.
NMR techniques to operate, adjust, and calibrate the spectrometers and acquire and process NMR data in one and two dimensional NMR applications.

CHEM 474 Environmental Chemistry (3 credits)
Prerequisite: CHEM481.
The sources of various elements and chemical reactions between them in the atmosphere and hydrosphere are treated. Causes and biological effects of air and water pollution by certain elements are discussed.

CHEM 481 Physical Chemistry I (3 credits)
Prerequisite: Minimum grade of C- in CHEM135; or minimum grade of C- in CHEM271 and CHEM272; or minimum grade of C- in CHEM276 and CHEM277. And minimum grade of C- in MATH141. And minimum grade of C- in PHYS260 and PHYS261; or minimum grade of C- in PHYS141.
Thermodynamics and kinetics of chemical and molecular systems. Topics may include internal energy, heat, work, enthalpy, entropy, free energy, and spontaneity as well as reaction order, differential rate laws, integrated rate laws, and rate laws for multi-step processes.

CHEM 482 Physical Chemistry II (3 credits)
Prerequisite: Minimum grade of C- in CHEM481.
Quantum mechanical nature of atoms and molecules. Topics may include model systems for electronic, vibrational, rotational and translational energies as well as connections to molecular spectroscopy and thermal distributions.

CHEM 483 Physical Chemistry Laboratory I (2 credits)
Prerequisite: Must have completed or be concurrently enrolled in CHEM481.
An introduction to the principles and application of quantitative techniques in physical chemical measurements. Experiments will be coordinated with topics in CHEM481.

CHEM 484 Physical Chemistry Laboratory II (2 credits)
Prerequisite: CHEM481 and CHEM483; and must have completed or be concurrently enrolled in CHEM482.
A continuation of CHEM 483. Advanced quantitative techniques necessary in physical chemical measurements. Experiments will be coordinated with topics in CHEM 482.

CHEM 498 Special Topics in Chemistry (3 credits)
Prerequisite: Prerequisite varies with the nature of the topic being considered.

CHEM 503 Physical Science for Elementary/Middle School Teachers III (4 credits)
A second-level survey of major chemistry concepts, with emphasis on the properties and behavior of common substances. Types of chemical reactions, the relationship between molecular structure and reactivity, periodicity, oxidation-reduction, acids and bases, equilibrium, and practical applications of chemistry. The laboratory portion of the course supports skills/understandings needed to prepare teachers for this aspect of physical science education.

CHEM 504 Fundamentals of Organic Chemistry and Biochemistry (4 credits)
Prerequisite: CHEM503; or students who have taken courses with comparable content may contact the department.
A one-semester survey of organic chemistry and biochemistry. The chemistry of carbon: aliphatic compounds, aromatic compounds, stereochemistry, halides, amines, amides, acids, esters, carbohydrates, and natural products. The laboratory experiments deal with synthetic and analytical organic activities.

CHEM 513 Principles of Chemistry II (4 credits)
Prerequisite: CHEM503; or students who have taken courses with comparable content may contact the department.
A continuation of the advanced survey of topics started in CHEM 503. Kinetics, thermodynamics, ionic equilibria, oxidation-reduction, electrochemistry, and the chemistry of common metals and nonmetals. Quantitative problem solving. Laboratory experiments, mostly quantitative in nature, support the topics developed in the lectures.

CHEM 521 Quantitative Analysis (4 credits)
Volumetric, gravimetric, electrometric and colorimetric methods in analytical inorganic chemistry.

CHEM 601 Structure and Bonding of Molecules and Materials (3 credits)
Development of the tools necessary to use the knowledge of structure and bonding of molecules and solids in the practice of synthetic inorganic and materials chemistry. Several bonding models are covered, from the simple valence bond and ligand field models to a quantitative group theoretical treatment of molecular orbital theory and band structure descriptions of solids. Concepts of electron counting and oxidation state and ligand characteristics are revisited in terms of the more sophisticated bonding models. Finally, these models are used to analyze the reactivity, magnetic and spectroscopic properties of inorganic coordination compounds. Prior advanced inorganic and/or advanced quantum chemistry courses are not prerequisites.

CHEM 602 Advanced Inorganic Chemistry II (3 credits)
Prerequisite: CHEM601; or permission of instructor.
A continuation of CHEM 601 with emphasis on the application of contemporary spectroscopic techniques to inorganic problems.

CHEM 608 Selected Topics in Inorganic Chemistry (1-3 credits)
Prerequisite: CHEM602 and CHEM601; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Topics of special interest and current importance.

CHEM 611 Professional Skills for New Graduate Students (1 credits)
Restriction: Must be in one of the following programs (Chemistry (Master's); Biochemistry (Master's); Biochemistry (Doctoral); Chemistry (Doctoral)) ; and must be a new graduate student.
Covers a wide range of topics in professional development for new graduate students.

CHEM 612 Scientific Presentations (1 credits)
Prerequisite: CHEM611.
Workshops will cover all aspects of giving scientific presentations. Each student will give a presentation based oon the topic of his/her final paper in CHEM611. Presentations will be critiqued by peers and faculty members.

CHEM 623 Optical Methods of Quantitative Analysis (3 credits)
Prerequisite: CHEM482; or students who have taken courses with comparable content may contact the department.
The quantitative applications of various methods of optical spectroscopy.

CHEM 624 Electrical Methods of Quantitative Analysis (3 credits)
Prerequisite: CHEM482; or students who have taken courses with comparable content may contact the department.
The use of conductivity, potentiometry, polarography, voltammetry, amperometry, coulometry, and chronopotentiometry in quantitative analysis.

CHEM 625 Separation Methods in Quantitative Analysis (3 credits)
Prerequisite: CHEM482; or students who have taken courses with comparable content may contact the department.
The theory and application for quantitative analysis of various forms of chromatography, ion exchange, solvent extraction, distillation, and mass spectroscopy.

CHEM 626 Metrology for Chemistry and Biochemistry (3 credits)
Prerequisite: CHEM481.
Metrology, the science of measurement, provides the tools required by decision makers to use measurement results to make confident decisions: normative international documents, specialized vocabulary, basic statistics, experimental design.

CHEM 640 Problems in Organic Reaction Mechanisms (1 credits)
A tutorial type course dealing with the basic description of the fundamentals of writing organic reaction mechanisms.

CHEM 641 Organic Reaction Mechanisms (3 credits)
Also offered as: CHEM441.

CHEM 647 Organic Synthesis (3 credits)
The use of new reagents in organic reactions; multistep syntheses leading to natural products of biological interest; stereospecific and regiospecific reactions and their use in total synthesis.

CHEM 648 Special Topics in Organic Chemistry (1-3 credits)
Repeatable to 9 credits if content differs.
Topics of special interest and current importance.

CHEM 650 Problems in Organic Synthesis (1 credits)
A tutorial type course dealing with mechanistic problems from the current literature of organic sysnthesis.

CHEM 678 Special Topics in Environmental Chemistry (3 credits)
Prerequisite: CHEM474. Repeatable to 6 credits if content differs.
In-depth treatment of environmental chemistry problem areas of current research interest. The topics will vary somewhat from year to year.

CHEM 682 Chemical Kinetics and Dynamics (3 credits)
Prerequisite: CHEM482; or permission of instructor. Restriction: Restricted to graduate students or advanced undergraduates with prerequisites.
The dynamics of atoms and molecules as they undergo chemical and physical change. Topics will be developed from a fundamental perspective and modern applications will be discussed. Topics include: chemical kinetics rate equations, atomic and molecular collisions; rate theories; atomic, molecular and chemical lasers; control of matter with light.

CHEM 684 Chemical Thermodynamics (3 credits)
Prerequisite: CHEM482; or students who have taken courses with comparable content may contact the department.

CHEM 687 Statistical Mechanics and Chemistry (3 credits)
Prerequisite: CHEM684; or students who have taken courses with comparable content may contact the department.

CHEM 688 Selected Topics in Physical Chemistry (2 credits)
Repeatable to 6 credits if content differs.

CHEM 689 Special Topics in Physical Chemistry (3 credits)
Repeatable to 9 credits if content differs.

CHEM 690 Quantum Chemistry I (3 credits)

CHEM 691 Quantum Chemistry II (3 credits)
Prerequisite: CHEM690 or PHYS622.

CHEM 698 Literature Seminar in Chemistry (1 credits)
Restriction: Must be in a major within CMNS-Chemistry & Biochemistry department.
Students will prepare and present a departmental seminar baseed on a topic in the current research literature.

CHEM 699 Special Problems in Chemistry (1-6 credits)
Prerequisite: One semester of graduate study in chemistry. Restriction: Restricted to students in the non-thesis M.S. option. Repeatable to 6 credits.
Laboratory experience in a research environment.

CHEM 703 Introduction to Nonequilibrium Statistical Physics (3 credits)
Prerequisite: PHYS603 or CHEM687; or permission of instructor. Credit only granted for: CHPH703, CHPH718B, CHEM703, CHEM718B, PHYS703, OR PHYS798Z. Formerly: CHEM718B.
Analysis and microscopic modeling of systems away from thermal equilibrium. Linear response theory, ergodicity, Brownian motion, Monte Carlo modeling, thermal ratchets, far-from-equilibrium fluctuation relations. Introduction to the theoretical tools of nonequilibrium phenomena and their application to problems in physics, chemistry and biology.

CHEM 705 Nuclear Chemistry (3 credits)
Nuclear structure models, radioactive decay processes, nuclear reactions in complex nuclei, fission, nucleosynthesis and nuclear particle accelerators.

CHEM 729 Special Topics in Geochemistry (1-3 credits)
Repeatable to 6 credits if content differs.
A discussion of current research problems.

CHEM 799 Master's Thesis Research (1-6 credits)

CHEM 889 Seminar (1 credits)

CHEM 898 Pre-Candidacy Research (1-8 credits)

CHEM 899 Doctoral Dissertation Research (1-8 credits)

Chinese (CHIN)

CHIN 401 Readings in Modern Chinese I (3 credits)

Prerequisite: CHIN302; or students who have taken courses with comparable content may contact the department. And must have taken a placement interview offered by the department for Non-majors.
Readings in history, politics, economics, sociology, and literature. Emphasis on wide-ranging, rapid reading, reinforced by conversations and compositions.

CHIN 402 Readings in Modern Chinese II (3 credits)
Prerequisite: CHIN401; or students who have taken courses with comparable content may contact the department. And must have taken a placement interview offered by the department for Non-majors.
Continuation of CHIN401.

CHIN 408 Selected Readings in Classical Chinese (3 credits)
Prerequisite: CHIN321; and must have knowledge of Pinyin. Repeatable to 9 credits if content differs.
Selected readings in Classical Chinese, including important representative works of history, poetry, and parallel prose. Close attention is paid to matters of grammar and phonology in the readings. Content will differ each time this course is offered.

CHIN 411 Business Chinese I (3 credits)
Prerequisite: CHIN402; or permission of ARHU-School of Languages, Literatures, and Cultures department. And must have taken a placement interview offered by the department for Non-majors.
Conversation, reading, and writing applicable to Chinese business transactions, social meetings, and meetings with government organizations, plus background material in English on professional business practices and social customs associated with business.

CHIN 412 Business Chinese II (3 credits)
Prerequisite: CHIN402; or permission of ARHU-School of Languages, Literatures, and Cultures department. And must have taken a placement interview offered by the department for Non-majors.
Continuation of CHIN411.

CHIN 415 Readings in Current Newspapers and Periodicals (3 credits)
Prerequisite: CHIN402; or students who have taken courses with comparable content may contact the department. And must have taken a placement interview offered by the department for Non-majors.
Reading of periodical literature on selected topics with discussions and essays in Chinese.

CHIN 418 Special Topics in Contemporary Chinese Fiction and Film (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 12 credits if content differs.
Various approaches to the most recent textual productions of China and Taiwan. Taught in Chinese.

CHIN 421 Theory of Chinese Phonetics and Phonology - Introduction (3 credits)
Prerequisite: Must have completed CHIN302 or higher.
Introduction to theories, terminology, and practical techniques for describing and analyzing Chinese speech sounds and their functions in the language. Taught in English.

CHIN 422 Chinese Grammar (3 credits)
Prerequisite: CHIN302; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Chinese sentence patterns studied and contrasted with English and in terms of current pedagogical as well as linguistic theories. Taught in English and Chinese.

CHIN 424 Linguistics of the Chinese Writing System (3 credits)
Prerequisite: JAPN405 or CHIN302. Recommended: CHIN423. Formerly: CHIN428A.
The history and structure of the Chinese writing system, with emphasis on its early development and place in the cognition of language. Students are expected to have advanced knowledge of written Chinese graphs (may include Japanese kanji or Korean hanja).

CHIN 428 Selected Topics in Chinese Linguistics (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Sophomore standing or higher. Repeatable to 12 credits if content differs.
Undergraduate seminar in Chinese linguistics. Topics may include the ancient writing system, historical phonology, dialectology, prosody and rhyming, grammar and the history of the language as a whole. This course may be repeated with different content, and satisfies the linguistics requirement for the Chinese major. Students are expected to be in at least Third Year Chinese. Taught in English.

CHIN 429 Selected Topics in Chinese Studies (3 credits)
Prerequisite: CHIN315. Repeatable to 6 credits if content differs.
In-depth study of a particular aspect of Chinese cultural, linguistic, literary studies. Specific topic to be announced when course is offered. Taught in English.

CHIN 432 Translation and Interpretation II (3 credits)
Prerequisite: CHIN402; or students who have taken courses with comparable content may contact the department. And permission of ARHU-School of Languages, Literatures, and Cultures department.
Workshop on Chinese/English translation and interpretation, with emphasis on seminar (consecutive) interpretation and introduction to conference (simultaneous) interpretation.

CHIN 441 Traditional Chinese Fiction (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Major works of fiction from the 4th century tales of the marvelous through the 19th century Qing novel. Readings are in classical Chinese and English. Designed for students with advanced language skills. Taught in English.

CHIN 442 Modern Chinese Fiction (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Examination, through selected texts, of the writer's role as shaper and reflector of the Republican and Communist revolutions. Taught in Chinese.

CHIN 443 Cultural Histories of Medicine in China (3 credits)
Restriction: Permission of department, School of Languages, Literatures and Cultures.
Investigates medical knowledge through traditional Chinese approaches to the body and beliefs about healing, including acupuncture, herbal medicine, prayer, ritual and folk medicine. Taught in English.

CHIN 499 Directed Study in Chinese (1-3 credits)
Prerequisite: Permission of instructor. Repeatable to 6 credits if content differs.
Readings in Chinese under faculty supervision.

CHIN 602 The Language of Contemporary Chinese Audio Media (3 credits)
Prerequisite: Must have taken a placement test offered by the department.

Oral Chinese non-fiction in the high diglossic register, with emphasis on contextually and culturally appropriate interpretation of lexicon, style, and idiom. Conducted entirely in Chinese, intended for non-native speakers of the language pursuing professional levels of competence.

CHIN 603 The Language of Contemporary Chinese Written Fiction (3 credits)
Prerequisite: Must have taken a placement test offered by the department.
Chinese fiction writing, with emphasis on contextually and culturally appropriate interpretation of lexicon, style, and idiom in various genres. Conducted entirely in Chinese; intended for non-native speakers of the language pursuing professional levels of competence.

CHIN 611 Structure of the Chinese Language (3 credits)
An overview of the basic linguistic characteristics of modern standard (Mandarin) Chinese, including phonology, morphology and syntax. Emphasis on the analysis of functional linguistic models and the development of student skills in critically appraising existing interpretations of Chinese language structure.

CHIN 621 Chinese Historical Linguistics (3 credits)
An introduction to the origin and development of the Chinese language, and its relationship to other languages.

Chemical Physics (CHPH)

CHPH 618 Special Projects in Chemical Physics (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Independent reading and study covering chemical physics subject areas not available in other courses.

CHPH 709 Seminar in Chemical Physics (1 credits)
Current research and developments in chemical physics.

CHPH 718 Special Topics in Chemical Physics (1-3 credits)
Repeatable to 99 credits if content differs.
A discussion of current research problems in chemical physics.

CHPH 799 Master's Thesis Research (1-6 credits)

CHPH 898 Pre-Candidacy Research (1-8 credits)

CHPH 899 Doctoral Dissertation Research (1-8 credits)

Classics (CLAS)

CLAS 409 Classics Capstone Seminar (3 credits)
Restriction: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.
Comparative study of selected central aspects of both ancient Greek and Roman cultures as viewed from the standpoints of literary study, history, art history, and other fields as appropriate. Seminar format involving intensive student research.

CLAS 419 The Classical Tradition (3 credits)
Repeatable to 9 credits if content differs. Credit only granted for: CLAS419 or CLAS420. Formerly: CLAS420.
Examination of the role of Greek and Roman civilization in shaping the arts and ideas of western culture.

CLAS 470 Approaches to Greek Mythology (3 credits)
Prerequisite: CLAS170; or permission of ARHU-Classics department.
Ancient and modern approaches to understanding Greek myth as expression of human experience, including interpretations drawn from psychology, anthropology, and comparative mythology.

CLAS 488 Independent Study in Classical Civilization (3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.

CLAS 495 Senior Thesis in Classics (3 credits)
Prerequisite: Permission of ARHU-Classics department.
Prior departmental approval of research topic is required.

CLAS 499 Independent Study in Classical Languages and Literatures (1-3 credits)
Prerequisite: Permission of ARHU-Classics department.

CLAS 621 The Classical Tradition (3 credits)
The role the classics have played in western thought, with particular attention to literature.

CLAS 688 Special Topics in Classical Civilization (3 credits)
Repeatable to 9 credits if content differs.

CLAS 699 Independent Study in Classical Civilization (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

CLAS 799 Master's Thesis Research (1-6 credits)

College of Chemical and Life Sciences (CLFS)

CLFS 510 Concepts of Modern Biology (3 credits)
Prerequisite: Permission of CMNS-Chemical & Life Sciences department.
Discussion of recent advancements in the biological sciences. Includes in depth treatment of the background information responsible for the advancements. Not acceptable for credit towards a degree.

CLFS 608 Seminar in Current Topics in Chemical and Life Science (1-3 credits)
Prerequisite: Two years of teaching experience; and CLFS510. Restriction: Must be in Master of Chemical & Life Sciences (Master's) program; and permission of CMNS-Chemical & Life Sciences department. Repeatable to 6 credits if content differs. Formerly: LFSC608.
Seminar in current topics in the Life Sciences. Contact Program Director or instructor before registering.

CLFS 609 Special Topics (1-3 credits)
Prerequisite: Two years of teaching experience; and CLFS510. Restriction: Must be in Master of Chemical & Life Sciences (Master's) program; and permission of CMNS-Chemical & Life Sciences department. Repeatable to 6 credits if content differs. Formerly: LFSC609.
Individual instruction course. Contact Program Director or instructor before registering.

CLFS 610 Natural Products Chemistry (3 credits)
Restriction: Permission of CMNS-Chemical & Life Sciences department. Credit only granted for: LFSC609D or LFSC610. Formerly: LFSC609D.
Foundations of natural products chemistry; how nature goes about making

(biosynthesizing) these compounds and elements of enzymology and genomics relevant to production of these compounds; relevance of natural products chemistry as a driving force for drug discovery and innovation in biotechnology.

CLFS 619 Special Topics in Chemistry (1-3 credits)
Repeatable to 9 credits if content differs. Formerly: LFSC619.
Topics of current interest and special importance.

CLFS 620 Modern Molecular Genetics (3 credits)
An overview of genetics including the genetic basis/components in prevalent diseases, genetically engineered organisms and foods, the importance of knowing the complete DNA sequence of organisms.

CLFS 630 Principles of Transmission Genetics: A Historical and Modern Perspective (3 credits)
Examines the origins of modern genetics, model genetic systems, and the role of chromosomes in vertical transmission of genetic information from parent to offspring. Classical gene mapping, population genetics and the various applications of modern genetics will also be studied.

CLFS 640 Human Physiology (3 credits)
Prerequisite: Two years of teaching experience; and CLFS510. Restriction: Must be in Master of Chemical & Life Sciences (Master's) program; and permission of CMNS-Chemical & Life Sciences department.
Examination of the major organ system of the human body and of the neural and hormonal mechanisms responsible for their regulation and control.

CLFS 655 The Chemistry and Applications of Electrochemical Cells (3 credits)
Chemistry of electrochemical cells including the thermodynamic basis for the production of electrical energy by cells, the chemical reactions utilized by the most common cells, the manufacture of cells, and the application of cells in energy production.

CLFS 660 Biodiversity and Conservation Biology (3 credits)
Application of ecological and evolutionary principles to assess the impact of the human species on the environment and its inhabitants. Specific case studies are included to illustrate problems of bidiversityloss and actions required to reverse the trends.

CLFS 665 Ecology and Global Change (3 credits)
Credit only granted for: LFSC609C or LFSC665. Formerly: LFSC609C.
Ecological concepts across scales ranging from the individual, to populations, communities, ecosystems, and landscapes will be presented. Global change issues will encompass alteration of atmospheric trace gases, biogeochemistry cycles, land use changes, and introduction of non-native species to new habitats.

CLFS 680 Chemical Ecology (3 credits)
An examination of the utilization of organic natural products by plants and animals for various life processes. Examples will include how materials are utilized for sexual selection, defense against predators, sexual attractants, and as natural herbicides and repellants.

CLFS 690 Biochemistry (3 credits)
An advanced overview of general biochemistry including a study of protein structure and their physical properties; how these properties relate to catalysis, regulation of catalysis and metabolic chemistry with respect to their relationship to physiological conditions.

CLFS 710 Experimental Biology (6 credits)
Formerly: LFSC710.
Participants develop skills in four areas of biological research while investigating a variety of biological systems. Those areas include: (1) iterative scientific methods, (2) basic laboratory techniques, (3) experimental design and analysis, and (4) critical evaluation of published research.

CLFS 725 Experimental Design (2 credits)
Credit only granted for: LFSC710, LFSC719, or LFSC725. Formerly: LFSC719.
Experimental design and statistics for science teachers that emphasizes the underlying structure of data and how this affects the quality and reliability of experiments. Examines the nature of data, the methods for designing rigorous experiments, important experimental design formats, and the relationships between data structure and analysis. Course work focuses on the design and analysis of orginal experiments for a series of research problems.

Comparative Literature (CMLT)

CMLT 469 The Continental Novel (3 credits)
The novel in translation from Stendhal through the existentialists, selected from literatures of France, Germany, Italy, Russia, and Spain.

CMLT 479 Major Contemporary Authors (3 credits)

CMLT 488 Genres (3 credits)
Repeatable to 6 credits if content differs.
A study of a recognized literary form, such as tragedy, film, satire, literary criticism, comedy, tragicomedy, etc.

CMLT 489 Major Writers (3 credits)
Each semester two major writers from different cultures and languages will be studied. Authors will be chosen on the basis of significant relationships of cultural and aesthetic contexts, analogies between their respective works, and the importance of each writer to his literary tradition.

CMLT 498 Selected Topics in Comparative Studies (3 credits)

CMLT 600 Introduction to Critical Theory (3 credits)
Prerequisite: Permission of ARHU-English department.
Introduction to the history of critical theory, its place in contemporary textual and cultural studies, and several theoretical schools of current significance.

CMLT 601 Problems in Comparative Studies (3 credits)
Restriction: Permission of ARHU-English department.

CMLT 639 Studies in the Renaissance (3 credits)
Repeatable to 9 credits.

CMLT 649 Studies in Eighteenth Century Literature (3 credits)
Repeatable to 9 credits.
Studies in eighteenth century literature: as announced.

CMLT 658 Studies in Romanticism (3 credits)
Repeatable to 9 credits.
Studies in romanticism: as announced.

CMLT 679 Topics in Comparative Studies (3 credits)
Repeatable to 9 credits.
Seminar in modern and contemporary literature: as announced.

CMLT 699 Independent Study (1-6 credits)
Restriction: Permission of instructor. Repeatable to 9 credits if content differs.

Research and writing on specific readings on a topic selected by the student which is approved and supervised by a faculty member.

CMLT 702 Cultures of Theory (3 credits)
Prerequisite: Must have completed an introductory course in critical theory. Also offered as: ENGL702. Credit only granted for: CMLT702 or ENGL702.
An exploration of the socio-historic, material, and cultural contexts of various theoretical practices and traditions.

CMLT 788 Practicum in Comparative Studies (1-6 credits)
Prerequisite: Permission of ARHU-English department. Repeatable to 20 credits if content differs.
Practical professional training for individuals and groups of students in supervised settings.

CMLT 798 Critical Theory Colloquium (1 credits)
Prerequisite: CMLT702 and CMLT701; or permission of instructor. Repeatable to 6 credits if content differs.
An intensive advanced exploration of current problems and issues in critical theory.

CMLT 799 Master's Thesis Research (1-6 credits)

CMLT 898 Pre-Candidacy Research (1-8 credits)

CMLT 899 Doctoral Dissertation Research (1-8 credits)

Computer, Mathematical and Physical Sciences (CMPS)

CMPS 618 Introduction to Earth System Science (3 credits)
Prerequisite: Permission of CMNS-Computer Science department. Repeatable to 6 credits if content differs.
A graduate seminar to introduce students to interdisciplinary concepts of earth system science. Interactions among the atmosphere, oceans, biosphere, solid earth and humans.

CMPS 628 Problems in Earth System Science (3 credits)
Prerequisite: CMPS618; or permission of CMNS-Computer Science department. Repeatable to 6 credits if content differs.
A graduate seminar focusing on methods to study the earth system. Interdisciplinary focus on research studying interactions among the atmosphere, oceans, biosphere, solid earth and humans.

Computer Science (CMSC)

CMSC 402 Bioinformatic Algorithms and Methods for Functional Genomics and Proteomics (3 credits)
Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and permission of CMNS-Computer Science department.
An introduction to the fundamental concepts in the computational analysis of biological systems with applications to: functional genomics, population genetics, proteomics and epigenetics. Computational concepts covered: network and graph algorithms, combinatorial algorithms, machine learning, large data/network visualization, statistical modeling and inference, probabilistic graphical models, sparse methods in data analysis, numerical optimization. No prior knowledge of biology required.

CMSC 411 Computer Systems Architecture (3 credits)
Prerequisite: Minimum grade of C- in CMSC330; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Restriction: Permission of CMNS-Computer Science department.
Input/output processors and techniques. Intra-system communication, buses, caches. Addressing and memory hierarchies. Microprogramming, parallelism, and pipelining.

CMSC 412 Operating Systems (4 credits)
Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Restriction: Permission of CMNS-Computer Science department.
A hands-on introduction to operating systems, including topics in: multiprogramming, communication and synchronization, memory management, IO subsystems, and resource scheduling polices. The laboratory component consists of constructing a small kernel, including functions for device IO, multi-tasking, and memory management.

CMSC 414 Computer and Network Security (3 credits)
Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Restriction: Permission of CMNS-Computer Science department.
An introduction to the topic of security in the context of computer systems and networks. Identify, analyze, and solve network-related security problems in computer systems. Fundamentals of number theory, authentication, and encryption technologies, as well as the practical problems that have to be solved in order to make those technologies workable in a networked environment, particularly in the wide-area Internet environment.

CMSC 417 Computer Networks (3 credits)
Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Computer networks and architectures. The OSI model including discussion and examples of various network layers. A general introduction to existing network protocols. Communication protocol specification, analysis, and testing.

CMSC 420 Data Structures (3 credits)
Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Description, properties, and storage allocation of data structures including lists and trees. Algorithms for manipulating structures. Applications from areas such as data processing, information retrieval, symbol manipulation, and operating systems.

CMSC 421 Introduction to Artificial Intelligence (3 credits)
Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Areas and issues in artificial intelligence, including search, inference, knowledge representation, learning, vision, natural languages, expert systems, robotics. Implementation and application of programming languages (e.g. LISP, PROLOG, SMALLTALK), programming techniques (e.g. pattern matching, discrimination networks) and control structures (e.g. agendas, data dependencies).

CMSC 422 Introduction to Machine Learning (3 credits)
Prerequisite: Minimum grade of C- in

CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Recommended: STAT400.
Machine Learning studies representations and algorithms that allow machines to improve their performance on a task from experience. This is a broad overview of existing methods for machine learning and an introduction to adaptive systems in general. Emphasis is given to practical aspects of machine learning and data mining.

CMSC 423 Bioinformatic Algorithms, Databases, and Tools (3 credits)
Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
An introduction to the main algorithms, databases, and tools used in bioinformatics. Topics may include assembly and analysis of genome sequences, reconstructing evolutionary histories, predicting protein structure, and clustering of biological data. Use of scripting languages to perform analysis tasks on biological data. No prior knowledge of biology is assumed.

CMSC 424 Database Design (3 credits)
Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Students are introduced to database systems and motivates the database approach as a mechanism for modeling the real world. An in-depth coverage of the relational model, logical database design, query languages, and other database concepts including query optimization, concurrency control; transaction management, and log based crash recovery. Distributed and Web database architectures are also discussed.

CMSC 425 Game Programming (3 credits)
Prerequisite: Minimum grade of C- in CMSC420.
An introduction to the principles and practice of computer game programming and design. This includes an introduction to game hardware and systems, the principles of game design, object and terrain modeling, game physics, artificial intelligence for games, networking for games, rendering and animation, and aural rendering. Course topics are reinforced through the design and implementation of a working computer game.

CMSC 426 Image Processing (3 credits)
Prerequisite: Minimum grade of C- in CMSC420; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Restriction: Permission of CMNS-Computer Science department.
An introduction to basic techniques of analysis and manipulation of pictorial data by computer. Image input/output devices, image processing software, enhancement, segmentation, property measurement, Fourier analysis. Computer encoding, processing, and analysis of curves.

CMSC 427 Computer Graphics (3 credits)
Prerequisite: MATH240; and minimum grade of C- in CMSC420; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
An introduction to the principles of computer graphics. Includes an introduction to graphics displays and systems. Introduction to the mathematics of affine and projective transformations, perspective, curve and surface modeling, algorithms for hidden-surface removal, color models, methods for modeling illumination, shading, and reflection.

CMSC 430 Introduction to Compilers (3 credits)
Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Topics include lexical analysis, parsing, intermediate representations, program analysis, optimization, and code generation.

CMSC 433 Programming Language Technologies and Paradigms (3 credits)
Prerequisite: Minimum grade of C- in CMSC330; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Restriction: Permission of CMNS-Computer Science department.
Programming language technologies (e.g., object-oriented programming), their implementations and use in software design and implementation.

CMSC 434 Introduction to Human-Computer Interaction (3 credits)
Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and PSYC100; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Assess usability by quantitative and qualitative methods. Conduct task analyses, usability tests, expert reviews, and continuing assessments of working products by interviews, surveys, and logging. Apply design processes and guidelines to develop professional quality user interfaces. Build low-fidelity paper mockups, and a high-fidelity prototype using contemporary tools such as graphic editors and a graphical programming environment (eg: Visual Basic, Java).

CMSC 435 Software Engineering (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (CMSC412, CMSC417, CMSC420, CMSC430, CMSC433); and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
State-of-the-art techniques in software design and development. Laboratory experience in applying the techniques covered. Structured design, structured programming, top-down design and development, segmentation and modularization techniques, iterative enhancement, design and code inspection techniques, correctness, and chief-programmer teams. The development of a large software project.

CMSC 436 Programming Handheld Systems (3 credits)
Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Restriction: Permission of CMNS-Computer Science department.
Fundamental principles and concepts that underlie the programming of handheld systems, such as mobile phones, personal digital assistants, and tablet computers. Particular emphasis will be placed on concepts such as limited display size, power, memory and CPU speed; and new input modalities, where handheld systems differ substantially from non-handheld systems, and thus require special programming tools and approaches. Students will apply these concepts and principles in the context of an existing handset programming platform.

CMSC 451 Design and Analysis of Computer Algorithms (3 credits)
Prerequisite: Minimum grade of C- in CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Fundamental techniques for designing efficient computer algorithms, proving their correctness, and analyzing their complexity. General topics include sorting, selection, graph algorithms, and basic algorithm design paradigms (such as

divide-and-conquer, dynamic programming and greedy algorithms), lower bounds and NP-completeness.

CMSC 452 Elementary Theory of Computation (3 credits)
Prerequisite: Minimum grade of C- in CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.
Alternative theoretical models of computation, types of automata, and their relations to formal grammars and languages.

CMSC 456 Cryptology (3 credits)
Prerequisite: (any two 400-level MATH courses; or (CMSC351 and CMSC330)); and permission of CMNS-Computer Science department. Or must be a CMSC graduate student. Also offered as: MATH456. Credit only granted for: CMSC456 or MATH456.
Importance in protecting data in communications between computers. The subject lies on the border between mathematics and computer science. Mathematical topics include number theory and probability, and computer science topics include complexity theory.

CMSC 460 Computational Methods (3 credits)
Prerequisite: MATH240 and MATH241; and (CMSC106 or CMSC131); and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Also offered as: AMSC460. Credit only granted for: AMSC460, AMSC466, CMSC460, or CMSC466.
Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.

CMSC 466 Introduction to Numerical Analysis I (3 credits)
Prerequisite: MATH240 and MATH241; and (CMSC106 or CMSC131); and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Also offered as: AMSC466. Credit only granted for: AMSC460, AMSC466, CMSC460, or CMSC466.
Floating point computations, direct methods for linear systems, interpolation, solution of nonlinear equations.

CMSC 474 Introduction to Computational Game Theory (3 credits)
Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Credit only granted for: CMSC474, ECON414, GVPT390 or GVPT399A.
Game theory deals with interactions among agents (either human or computerized) whose objectives and preferences may differ from the objectives and preferences of the other agents. It will also provide a comprehensive introduction to game theory, concentrating on its computational aspects.

CMSC 475 Combinatorics and Graph Theory (3 credits)
Prerequisite: MATH240 and MATH241; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program. Also offered as: MATH475.
General enumeration methods, difference equations, generating functions. Elements of graph theory, matrix representations of graphs, applications of graph theory to transport networks, matching theory and graphical algorithms.

CMSC 498 Selected Topics in Computer Science (1-3 credits)
Restriction: Permission of CMNS-Computer Science department.
An individualized course designed to allow a student or students to pursue a selected topic not taught as a part of the regular course offerings under the supervision of a Computer Science faculty member. In addition, courses dealing with topics of special interest and/or new emerging areas of computer science will be offered with this number. Selected topics courses will be structured very much like a regular course with homework, project and exams. Credit according to work completed

CMSC 499 Independent Undergraduate Research (1-3 credits)
Restriction: Must be in one of the following programs (Computer Science; Engineering: Computer) ; and permission of CMNS-Computer Science department.
Students are provided with an opportunity to participate in a computer science research project under the guidance of a faculty advisor. Format varies. Students and supervising faculty member will agree to a research plan which must be approved by the department. As part of each research plan, students should produce a final paper delineating their contribution to the field.

CMSC 630 Foundations of Software Verification (3 credits)
Prerequisite: CMSC330; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Topics in program verification. Operational semantics of programs. Preconditions and postconditions. Axiomatic proof systems and predicate transformers. Temporal logic and model checking. Process algebra, semantic equivalences and algebraic reasoning.

CMSC 631 Program Analysis and Understanding (3 credits)
Prerequisite: CMSC330; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Techniques for static analysis of source code and modern programming paradigms. Analysis techniques: data flow analysis, program dependence graphs, program slicing, abstract interpretation. The meaning of programs: denotational semantics, partial evaluation. Advanced treatment of abstraction mechanisms: polymorphic types, operation overloading, inheritance, object-oriented programming and ML-like programming languages.

CMSC 634 Empirical Research Methods for Computer Science (3 credits)
Recommended: An introductory statistics class. Restriction: Must be in Computer Science (Master's) program; or must be in Computer Science (Doctoral) program; or permission of instructor. Credit only granted for: CMSC838G (Fall2005) or CMSC634.
A graduate-level introductory course on empirical reseach methods for computer scientists. Experimental techniques for evaluating software systems and processes, human performance using interfaces, programming environments, and software engineering methods. Introduction to constructs and methods of measurements, qualitative and quantitative design, quasi-experimental and non-experimental design, baseline design, and statistical analysis.

CMSC 651 Analysis of Algorithms (3 credits)
Prerequisite: CMSC451.
Efficiency of algorithms, orders of magnitude, recurrence relations, lower-bound techniques, time and space resources, NP-complete problems, polynomial hierarchies, and approximation algorithms. Sorting, searching, set manipulation, graph theory, matrix multiplication, fast Fourier transform, pattern matching, and integer and polynomial arithmetic.

CMSC 652 Complexity Theory (3 credits)

Prerequisite: CMSC451 or CMSC452; or permission of instructor. Credit only granted for: CMSC652 or CMSC858G. Formerly: CMSC858G.
This course will define what it means for a problem to be hard (or easy) in a variety of ways. The emphasis will be on natural problems. Topics may include NP-completeness, Sparse Sets, Graph Isomoprhism (why it is thought to not be NP-complete), Counting problems, and approximation problems.

CMSC 656 Introduction to Cryptography (3 credits)
Prerequisite: CMSC451, CMSC452, or CMSC456. Credit only granted for: CMSC656 or CMSC858K. Formerly: CMSC858K.
Introduction to modern cryptography. Topics include symmetric-key encryption, hash functions, message-authentication codes, block-cipher design, theoretical foundations, number theory, public-key encryption, and digital signatures.

CMSC 660 Scientific Computing I (3 credits)
Prerequisite: Must have knowledge of C or Fortran. And CMSC466, AMSC466, AMSC460, or CMSC460; or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: AMSC660. Credit only granted for: AMSC660 or CMSC660.
Monte Carlo simulation, numerical linear algebra, nonlinear systems and continuation method, optimization, ordinary differential equations. Fundamental techniques in scientific computation with an introduction to the theory and software for each topic.

CMSC 661 Scientific Computing II (3 credits)
Prerequisite: Must have knowledge of C or Fortran. And CMSC466, AMSC466, AMSC460, or CMSC460; or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: AMSC661. Credit only granted for: AMSC661 or CMSC661.
Fourier and wavelet transform methods, numerical methods for elliptic partial differential equations, numerical linear algebra for sparse matrices, Finite element methods, numerical methods for time dependent partial differential equations. Techniques for scientific computation with an introduction to the theory and software for each topic. Course is part of a two course sequence (660 and 661), but can be taken independently.

CMSC 662 Computer Organization and Programming for Scientific Computing (3 credits)
Prerequisite: Must have Knowledge of C or Fortran. And CMSC466, AMSC466, AMSC460, or CMSC460; or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: AMSC662. Credit only granted for: AMSC662 or CMSC662.
This course presents fundamentals issues of computer hardware, software, parallel computing, and scientific data management for programming for scientific computation.

CMSC 663 Advanced Scientific Computing I (3 credits)
Also offered as: AMSC663. Credit only granted for: AMSC663 or CMSC663.
In the sequence CMSC663, CMSC664 students work on a year-long individual project to develop software for a scientific task in a high perfomance computing environment. Lectures will be given on available computational environments, code development, implementation of parallel algorithms.

CMSC 664 Advanced Scientific Computing II (3 credits)
Prerequisite: CMSC663. Restriction: Permission of instructor. Also offered as: AMSC664. Credit only granted for: AMSC664, or CMSC664.
In the sequence CMSC 663, CMSC 664 students work on a year-long individual project to develop software for a scientific task in a high performance computing environment. Lectures will be given on code development and validation, parallel algorithms for partial differential equations, nonlinear systems, optimization.

CMSC 666 Numerical Analysis I (3 credits)
Prerequisite: CMSC466 or AMSC466; and MATH410. Also offered as: AMSC666. Credit only granted for: AMSC666 or CMSC666.
Interpolation and approximation, numerical integration, solution algorithms for nonlinear systems of equations, numerical optimization.

CMSC 667 Numerical Analysis II (3 credits)
Prerequisite: AMSC666 or CMSC666. Also offered as: AMSC667. Credit only granted for: AMSC667 or CMSC667.
Numerical solution of initial value problems, numerical solution of boundary value problems, iterative methods for linear systems of equations, numerical methods for eigenvalue problems.

CMSC 701 Computational Genomics (3 credits)
An introduction to the algorithms and heuristics used in the analysis of biological sequences. Includes an introduction to string matching and alignment algorithms, phylogenetic analysis, string reconstruction (genome assembly), and sequence pattern recognition (gene and motif finding). A particular emphasis will be placed on the design of efficient algorithms and on techniques for analyzing the time and space complexity of these algorithms. Computational concepts will be presented in the context of current biological applications. No prior knowledge of biology necessary.

CMSC 702 Computational Systems Biology (3 credits)
An introduction to the fundamental concepts in the computational analysis of biological systems with applications to: functional genomics, population genetics, interaction networks, epigenetics. Computational concepts convered: network and graph algorithms, machine learning, large data/network visualization, statistical modeling and inference, probabilistic graphical models, sparse methods in data analysis, numerical optimization. No prior knowledge of biology required.

CMSC 711 Computer Networks (3 credits)
Prerequisite: CMSC412; or students who have taken courses with comparable content may contact the department.
Priciples, design, and performance evaluation of computer networks. Network architectures including the ISO model and local area networks (LANs). Communication protocols and network topology.

CMSC 712 Distributed Algorithms and Verification (3 credits)
Study of algorithms from the distributed and concurrent systems literature. Formal approach to specifying, verifying, and deriving such algorithms. Areas selected from mutual exclusion, resource allocation, quiescence detection, election, Byzantine agreements, routing, network protocols, and fault-tolerence. Formal approaches will handle system specification and verification of safety, liveness, and real-time properties.

CMSC 722 Artificial Intelligence Planning (3 credits)
Prerequisite: CMSC421; or students who have taken courses with comparable content may contact the department; or permission of CMNS-Computer Science department.
Automated planning of actions to accomplish some desired goals. Basic algorithms, important systems, and new directions in the field of artificial intelligence planning systems.

CMSC 723 Computational Linguistics I (3 credits)
Prerequisite: CMSC421; or students

who have taken courses with comparable content may contact the department; or permission of instructor. Also offered as: LING723, INST735. Credit only granted for: CMSC723, LING723, or INST735. Additional information: May only receive PhD Comp. credit for CMSC723 or CMSC823, not both.
Fundamental methods in natural language processing. Topics include: finite-state methods, context-free and extended context-free models of syntax; parsing and semantics interpretation; n-gram and Hidden Markov models, part-of-speech tagging; natural language applications such as machine translation, automatic summarization, and question answering.

CMSC 724 Database Management Systems (3 credits)

Restriction: Must be in one of the following programs (Computer Science (Master's); Computer Science (Doctoral)) ; or permission of instructor; or permission of CMNS-Computer Science department.
Theoretical and implementation issues in advanced database systems. Topics include distributed databases, parallel databases, database client-server architectures, multimedia access methods, advanced query optimization techniques, data semantics and models, object-oriented databases, and deductive and expert database systems.

CMSC 725 Geographical Information Systems and Spatial Databases (3 credits)

Prerequisite: CMSC424 and CMSC420; or permission of instructor.
Topics in geographic information systems and spatial databases. Integrates related results from databases, cartography, geography, computer graphics, file access methods, computational geometry, image processing, data structures, and programming languages. Topics include: cartographic modeling, principles of cartography, methods from computational geometry, principles of spatial databases, access methods, and spatial data structures. The architecture of some existing spatial databases and geographic information systems will be examined in greater detail.

CMSC 726 Machine Learning (3 credits)

Prerequisite: CMSC421; or students who have taken courses with comparable content may contact the department; or permission of instructor.
An introduction to modern statistical data analysis using machine learning techniques. The course quickly surveys elementary statistical models (decision trees, nearest neighbors and linear regression) and moves on to more complex algorithms such as support vector machines, boosting, neural networks, structured prediction, apprenticeship learning, online learning, bandits, recommender systems and reinforcement learning. Throughout an emphasis is placed on mathematical rigor.

CMSC 727 Neural Modeling (3 credits)

Prerequisite: CMSC421; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Fundamental methods of neural modeling. Surveys historical development and recent research results from both the computational and dynamical systems perspective. Logical neurons, perceptrons, linear adaptive networks, attractor neural networks, competitive activation methods, error back-propagation, self-organizing maps, and related topics. Applications in artificial intelligence, cognitive science, and neuroscience.

CMSC 733 Computer Processing of Pictorial Information (3 credits)

Prerequisite: CMSC420.
Input, output, and storage of pictorial information. Pictures as information sources, efficient encoding, sampling, quantization, approximation. Position-invariant operations on pictures, digital and optical implementations, the pax language, applications to matched and spatial frequency filtering. Picture quality, image enhancement and image restoration. Picture properties and pictorial pattern recognition. Processing of complex pictures; figure extraction, properties of figures. Data structures for pictures description and manipulation; picture languages. Graphics systems for alphanumeric and other symbols, line drawings of two- and three-dimensional objects, cartoons and movies.

CMSC 734 Information Visualization (3 credits)

Prerequisite: CMSC434; or must have experience in Human-Computer interaction. Formerly: CMSC838F.
Information visualization defined in relation to graphics, scientific visualization, databases, data mining, and human-computer interaction. Visualizations for dimensional, temporal, hierarchical and network data. Examines design alternatives, algorithms and data structures, coordinated views, and human factors evaluations of efficacy.

CMSC 737 Fundamentals of Software Testing (3 credits)

Prerequisite: CMSC435; or students who have taken courses with comparable content may contact the department; or permission of instructor. Formerly: CMSC838M.
Examine fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing th significance of each phase when testing different types of software. Concepts include: test generation, oracles, prioritization and coverage, regression and mutation testing, and program analysis.

CMSC 740 Advanced Computer Graphics (3 credits)

Prerequisite: MATH240 and CMSC420; or permission of instructor.
An introduction to the principles of computer graphics. Includes an introduction to graphics displays and systems, introduction to the mathematics of affine and projective transformations, perspective, curve and surface modeling, algorithms for hidden-surface removal, color models, methods for modeling illumination, shading, and reflection.

CMSC 741 Geometric and Solid Modeling (3 credits)

Prerequisite: MATH240 and CMSC420; or permission of instructor. Formerly: CMSC828D.
An introduction to modeling and mesh-based representations for solid objects, surfaces, and scalar fields; boundary and volumetric models for solid objects. Applications to computer aided design, computer graphics, scientific visualization, finite elements, computer vision, and robotics.

CMSC 751 Parallel Algorithms (3 credits)

Prerequisite: CMSC451; or students who have taken courses with comparable content may contact the department.
A presentation of the theory of parallel computers and parallel processing. Models of parallel processing and the relationships between these models. Techniques for the design and analysis of efficient parallel algorithms including parallel prefix, searching, sorting, graph problems, and algebraic problems. Theoretical limits of parallelism, inherently sequential problems, and the theory of P-completeness.

CMSC 754 Computational Geometry (3 credits)

Prerequisite: CMSC451 and CMSC420; or permission of instructor.
Introduction to algorithms and data structures for computational problems in discrete geometry (for points, lines, and polygons) primarily in two and three dimensions. Topics include triangulations and planar subdivisions, geometric search and intersection, convex hulls, Voronoi diagrams, Delaunay triangulations, line arrangements, visibility, and motion planning.

CMSC 760 Advanced Linear Numerical Analysis (3 credits)

Prerequisite: AMSC666 or CMSC666; or permission of instructor. Also offered as: AMSC600. Credit only granted for:

AMSC600 or CMSC760. Formerly: CMSC770.
Advanced topics in numerical linear algebra, such as dense eigenvalue problems, sparse elimination, iterative methods, and other topics.

CMSC 764 Advanced Numerical Optimization (3 credits)
Prerequisite: MATH410; or permission of instructor. Also offered as: AMSC607. Credit only granted for: AMSC607 or CMSC764. Formerly: CMSC878O.
Modern numerical methods for solving uncontrained and constrained nonlinear optimization problems in finite dimensions. Design of computational algorithms and the analysis of their properties.

CMSC 773 Computational Linguistics II (3 credits)
Prerequisite: LING723 or CMSC723; or permission of instructor. Also offered as: LING773. Formerly: CMSC828R. Additional information: May only receive PhD Comp. credit for CMSC723 or CMSC823, not both.
Natural language processing with a focus on corpus-based statistical techniques. Topics inlcude: stochastic language modeling, smoothing, noisy channel models, probabilistic grammars and parsing; lexical acquisition, similarity-based methods, word sense disambiguation, statistical methods in NLP applications; system evaluation.

CMSC 798 Graduate Seminar in Computer Science (1-3 credits)

CMSC 799 Master's Thesis Research (1-6 credits)

CMSC 818 Advanced Topics in Computer Systems (1-3 credits)
Restriction: Permission of instructor. Repeatable to 99 credits.
Advanced topics selected by the faculty from the literature of computer systems to suit the interest and background of students.

CMSC 828 Advanced Topics in Information Processing (1-3 credits)
Restriction: Permission of instructor. Repeatable to 99 credits.
Advanced topics selected by the faculty from the literature of information processing to suit the interest and background of students.

CMSC 838 Advanced Topics in Programming Languages (1-3 credits)
Restriction: Permission of instructor. Repeatable to 99 credits.
Advanced topics selected by faculty from the literature of programming languages to suit the interest and background of students.

CMSC 858 Advanced Topics in Theory of Computing (1-3 credits)
Restriction: Permission of instructor. Repeatable to 99 credits.
Advanced topics selected by the faculty from the literature of theory of computing to suit the interest and background of students.

CMSC 878 Advanced Topics in Numerical Methods (1-3 credits)
Restriction: Permission of instructor. Repeatable to 99 credits.
Advanced topics selected by the faculty from the literature of numerical methods to suit the interest and background of students.

CMSC 898 Pre-Candidacy Research (1-8 credits)
Restriction: Permission of instructor.
Prerequisite: permission of instructor.
Advanced topics selected by the faculty from the literature of applications of computer science to suit the interest and background of students. May be repeated for credit.

CMSC 899 Doctoral Dissertation Research (1-8 credits)

Communication (COMM)

COMM 400 Research Methods in Communication (3 credits)
Prerequisite: COMM250; and must have an introductory course in statistics. Restriction: Must be in Communication program.
Philosophy of scientific method; role of theory; research ethics; empirical research methods (measurement, sampling, design, analysis).

COMM 401 Interpreting Strategic Discourse (3 credits)
Prerequisite: COMM250. Restriction: Must be in Communication program.
Principles and approaches for practical analysis of discourse designed to shape audience opinion.

COMM 402 Communication Theory and Process (3 credits)
Prerequisite: COMM250. Restriction: Must be in Communication program.
Philosophical and conceptual analysis of communication theories.

COMM 420 Theories of Group Discussion (3 credits)
Current theory, research and techniques regarding small group process, group dynamics, leadership and decision-making.

COMM 421 Communicating Leadership (3 credits)
Examines the nature of leadership, theories of leadership from a communication perspective, relationships between leadership, authority, power, and ethics. Explores leadership responsibilities, commitments, and actions.

COMM 422 Communication Management (3 credits)
Communication policies, plans, channels, and practices in the management of the communication function in organizations.

COMM 423 Communication Processes in Conferences (3 credits)
Group participation in conferences, methods of problem solving, semantic aspects of language, and the function of conferences in business, industry and government settings.

COMM 424 Communication in Complex Organizations (3 credits)
Structure and function of communication within organizations: organizational climate and culture, information flow, networks and role relationships.

COMM 425 Negotiation and Conflict Management (3 credits)
Role of communication in shaping negotiation and conflict processes and outcomes.

COMM 426 Conflict Management (3 credits)
Recommended: COMM425; and COMM250; and COMM402.
Role of communication in managing conflict processes.

COMM 427 Crisis Communication (3 credits)
Credit only granted for: COMM398C or COMM427. Formerly: COMM398C.
Explores theories and research related to communication before, during, and after a crisis. Students examine the fundamentals of organizational communication, crisis management, and strategic and crisis communication planning before examining case studies of a number of real-life crises: organizational crises, natural disasters, accidents, terrorism incidents, health crises, and major crises of credibility.

COMM 430 Public Relations Theory and Techniques (3 credits)
Prerequisite: JOUR201; or students who have taken courses with comparable content may contact the department. And permission of ARHU-Communication department. Restriction: Must not have completed COMM350. Credit only granted for: COMM350, COMM430, COMM630, or (JOUR530 and JOUR630). Formerly: JOUR530.
Theories relevant to the strategic management of public relations and techniques used in programs to communicate with publics of organizations

COMM 435 Theories of Interpersonal Communication (3 credits)
Prerequisite: COMM400; or permission of ARHU-Communication department.
Major theoretical approaches and research trends in the study of interpersonal communication.

COMM 436 Interpersonal Arguing (3 credits)
Prerequisite: COMM400 and COMM250. Restriction: Must be in Communication program. Credit only granted for: COMM436 or COMM498I. Formerly: COMM498I.
An examination of face to face arguing.

COMM 450 Ancient and Medieval Rhetorical Theory (3 credits)
Prerequisite: COMM250. Restriction: Must be in Communication program. Credit only granted for: COMM450 or COMM650.
A survey of rhetorical theory in the ancient and medieval periods. Emphasis is placed on the theoretical problems that gave rise to its development within both periods. Authors include Isocrates, Plato, Aristotle, Cicero, Quintilian, Hermogenes, Martianus Capella, Aurelius Augustine, Alberic of Monte Cassino, Geoffrey of Vinsauf and Robert of Basevorn.

COMM 451 Renaissance & Modern Rhetoric Theory (3 credits)
A survey of rhetorical theory in the renaissance and modern periods. Emphasis is placed on the theoretical trends that dominate rhetorical thinking during both periods--especially in Great Britain. Authors include Wilson, Sherry, Rainolde, Day, Hyperius, Cox, Ramus, Talon, Bacon, Pascal, Fenelon, Sheridan, Campbell, Blair, and Whately.

COMM 453 The Power of Discourse in American Life (3 credits)
The potential of language forms and strategic discourse to create, perpetuate, and alter patterns of political and cultural behavior. The influence of contemporary political and cultural discourse on public understanding, public policy, and day-to-day life.

COMM 454 Rhetoric of the 1960s (3 credits)
Prerequisite: COMM401; or permission of ARHU-Communication department. Restriction: Must not have completed COMM453 (Spring2003).
Study of key rhetoric of the 1960s. Treats rhetoric of relevant Presidents and several protest movements including civil rights, anti-war, and women's liberation. Contrasts traditional modes of argument with alternative rhetorical forms.

COMM 455 Speechwriting (3 credits)
The study of message strategies in order to research and develop effective speech texts appropriate to speakers and their audiences in various public contexts.

COMM 458 Seminar in Political Communication (3 credits)
Prerequisite: COMM250. Repeatable to 6 credits if content differs.
The examination of special topics for and theories of political communication.

COMM 460 Public Life in American Communities, 1634-1900 (3 credits)
Ways that Americans have used their voice to create public life. Focus is on the diverse social communities that have characterized American life and the place and characteristics of oral discourse in each.

COMM 461 Voices of Public Leadership in the Twentieth Century (3 credits)
Study of the use of speaking in the power struggles of the twentieth century. Focus is on important speakers of the century, their social and policy influence, and the struggle to expand the diversity of voices with power in the public sphere.

COMM 468 Seminar in Mediated Communication (3 credits)
Prerequisite: COMM402, COMM450, COMM350, or JOUR350. Restriction: Junior standing or higher. Repeatable to 6 credits if content differs.
The examination of special topics related to the study of mediated communication.

COMM 469 The Discourse of Social Movements (3 credits)
Recommended: COMM401. Restriction: Junior standing or higher. Repeatable to 6 credits if content differs.
Study of key social movements that have influenced American social and political life. In alternate years the Civil Rights Movement and the Rhetoric of Women's Suffrage and Abolitionism. Consideration of how groups excluded from or marginalized in American political life affect social change.

COMM 470 Listening (3 credits)
The principles of listening behavior.

COMM 471 Public Communication Campaigns (3 credits)
Prerequisite: COMM200; or permission of ARHU-Communication department.
Diffusion theory and its implications for public communication campaigns.

COMM 472 Nonverbal Communication (3 credits)
Nonverbal communication in human interaction theory and research on proxemics, kinesics and paralanguage as expression of relationship, affect and orientation within and across cultures.

COMM 475 Persuasion (3 credits)
Bases of persuasion, with emphasis on recent experimental developments in persuasion.

COMM 476 Language, Communication, and Action (3 credits)
The nature of communication as symbolic action. Topics include language, meaning, intention, understanding, and consequences of communication.

COMM 477 Discourse Analysis (3 credits)
Concepts of textual and discourse analysis applied to speech situations.

COMM 478 Communication Colloquium (1 credits)
Repeatable to 4 credits if content differs.
Current trends and issues in the field of communication, stressing recent research methods. Recommended for senior and graduate student majors and minors in communication.

COMM 482 Intercultural Communication (3 credits)
The major variables of communication in an intercultural context: cultural, racial and national differences; stereotypes; values; cultural assumptions; and verbal and nonverbal channels.

COMM 483 Senior Seminar in Public Relations (3 credits)
Prerequisite: COMM351 and COMM400. Credit only granted for: COMM483 or JOUR483. Formerly:

JOUR483.
Integration of theory, techniques and research methods into the planning and execution of public relations campaigns for specific organizations. Analysis of research on the case studies of public relations.

COMM 488 Communication Portfolio Project (1 credits)
Restriction: Senior standing; and must be in Communication program.
Repeatable to 3 credits if content differs.
Preparation of the professional communication portfolio.

COMM 489 Topical Research (1-3 credits)
Prerequisite: Permission of ARHU-Communication department.
Repeatable to 6 credits if content differs.
Individualized research projects conducted with a faculty sponsor.

COMM 498 Seminar (3 credits)
Restriction: Permission of instructor; and senior standing.
Present-day communication research.

COMM 600 Empirical Research in Communication (3 credits)
Formerly: SPCH600.

COMM 601 Historical-Critical Research in Communication (3 credits)
Formerly: SPCH601.
Intense study in critical and historical methodology as applicable to research in communication. Emphasis will be placed on the composition and the evaluation of historical-critical studies of significance in the field of rhetorical communication scholarship.

COMM 602 Communication Theory (3 credits)
Restriction: Must be in one of the following programs (Communication (Master's); Communication (Doctoral)).
Fundamental concepts, approaches, and problems in communication theory.

COMM 604 Argumentation Theory (3 credits)
Fundamental concepts, approaches, and problems in argumentation theory.

COMM 605 Interpersonal Arguing (3 credits)
Examination of interpersonal arguing. Topics include invention, form, and editing of argumentative content, presentation of such content in face-to-face conversation, and reaction to the content. Cognitive and other psychological approaches predominate, but some attention is given to rhetorical and philosophical traditions.

COMM 606 Seminar in Communication Management (3 credits)
Restriction: Restricted to GCPS (Z045) in Communication; or must be in Public Management-Executive Masters (Master's) program.
Communication and public relations as a managed function of organizations are introduced. Students learn how managing communication contributes to organizational effectiveness. Using organizational theory, theories of Excellence in public relations and communication management, communication metrics and communication ethics, students build their communication strategic management skills beyond the programmatic level to the functional and organizational levels of decision-making.

COMM 607 Seminar in Communication Management Publics (3 credits)
Restriction: Restricted to GCPS (Z045) in Communication; or must be in Public Management-Executive Masters (Master's) program.
Research and analysis of publics and how the use of this information builds more effective relationships with strategic constituencies of organizations are emphasized. Students learn and apply to communication management problems the theories of audience segmentation, stakeholders, behavior of activist organizations, conflict resolution, environmental scanning, ethics of organization-public relationships and the situational theory of publics.

COMM 609 Fundamentals of Interpreting (1-6 credits)
Prerequisite: Students must complete an admissions test for first year courses; and permission of ARHU-Communication department.
Repeatable to 8 credits.
Develops a systematic, reflective approach to interpreting tasks in real-world settings and outlines the use of different modes of interpreting under professional working conditions. Provides an overview of interpreting skills with exercises to develop them, including focus on active listening and analysis, effective use of memory, and delivery of the target message. Interpreting strategies and techniques in both dialogue and formal consecutive settings are discussed and practiced in a range of interpreting domains. Includes sight translation.

COMM 610 Introduction to Translation and Interpreting Studies (3 credits)
Prerequisite: Students must complete an admissions test for first year courses; and permission of ARHU-Communication department.
Provides an overview of the interdisciplinary fields of Translation and Interpreting Studies and establishes relationships between scholarly study and professional practice. Examines how theories and concepts inform practice, guide to a higher level of competence, and address issues of interlingual, intercultural mediation in authentic, real-world settings both past and present. serves as a foundation course for reflective practice and portfolio work through action research methodology and process

COMM 611 Semniar in Global Communcation Mangement (3 credits)
Restriction: Restricted to GCPS (Z045) in Communication; or must be in Public Management-Executive Masters (Master's) program.
Global Communication Management extends the theories of communication management developed in COMM606 and COMM607 to a global level. Students move beyond Western communication management assumptions to examine how practices of communication management differ in different national and/or cultural contexts. Students are challenged to build generic principles of communication management with specific applications that can be used and adapted in the differing countries and cultures of the world whether working in multinational corporations, national governments, or non-governmental organizations (NGO's).

COMM 619 Consecutive Interpretation (2-6 credits)
Prerequisite: COMM609; and must have completed an admissions test for first year courses; and permission of ARHU-Communication department.
Repeatable to 8 credits.
Builds upon the systematic, reflective approach to interpreting in real-world settings introduced in Fundamentals of Interpreting. Consecutive interpreting skills are consolidated through individual and group practice, and any remaining challenges related to consecutive interpreting sub-skills are identified and addressed. Stresses effective analysis, note-taking, and use of voice during exercises in sight translation, dialogue, and formal consecutive interpreting.

COMM 625 Negotiation (3 credits)
Role of communication in shaping negotiation processes and outcomes.

COMM 626 Conflict Management (3 credits)
Formerly: SPCH626.
Role of communication in managing conflict processes.

COMM 628 Organization Communication: Research and

Intervention (3 credits)
Prerequisite: COMM424; or permission of instructor. Repeatable to 6 credits if content differs. Formerly: SPCH628.
The role of the internal and external communication consultant as an organizational change-agent. Emphasis upon data gathered to facilitate the communication development of the organization.

COMM 629 Introduction to Simultaneous Interpretation (1 credits)
Prerequisite: Admissions test for Graduate Certificate in Interpreting; and COMM609; and permission of ARHU-Communication department. Recommended: COMM619. Repeatable to 3 credits if content differs.
Builds upon the overview of the simultaneous mode in Fundamentals of Interpreting by reviewing the relationship between consecutive and simultaneous skills and introducing work in the booth. Challenges of simultaneous interpreting, including split attention, ear-voice span, and voice and microphone technique are addressed. Participants become familiar with the booth and exercises required to build simultaneous skills. Role and use of portable equipment in professional settings are discussed. Recommended as preparation for the M.A. entrance examination.

COMM 630 Seminar in Public Relations Management (3 credits)
Credit only granted for: COMM630 or JOUR630. Formerly: JOUR630.
Relationship of public relations management to organizational structure and communication functions. Objectives, planning, staffing, budgeting, administering, and evaluation of public relations programs.

COMM 631 Seminar in Public Relations Publics (3 credits)
Credit only granted for: COMM631 or JOUR631. Formerly: JOUR631.
Analysis of public relations programs aimed at organizational publics. Media, issue-related, community, employee, governmental, consumer, financial, and student/educator publics. Theories of the nature of publics, communication behavior of publics, and effects of public relations programs aimed at different publics.

COMM 633 Global Public Relations (3 credits)
Credit only granted for: COMM633 or JOUR633. Formerly: JOUR633.
Application of principles of public relations to countries or regions with different cultures, political systems, economic systems, levels of development, media systems, and levels of activism.

COMM 634 Seminar in Ethics and Philosophy of Public Relations (3 credits)
Credit only granted for: COMM634 or JOUR634. Formerly: JOUR634.
Exploration of the emergent philosophy of public relations; ethical issues including accountability, social responsibility, philanthropy, multicultural and gender issues, fee structure, professionalism, divided loyalties, and confidentiality.

COMM 637 Professional Practice Forum in Translation: Career Portfolio and Exams (1 credits)
Prerequisite: Admissions test for second year courses; and (COMM659 and COMM679); and permission of ARHU-Communication department.
Serves as final preparation for entry into the profession through development of career portfolio to meet summative degree requirement and development of strategies for gaining work as a professional translator. Prepares participants for degree examinations and employer tests through the review of previous exam material and employer testing requirements. Serves as venue for degree examinations, career goal setting and planning for future employment. Participants present and defend career portfolio as summative requirement for MA in translation; MA in Trans. and Localization Project.

COMM 639 Fundamentals of Translation (1-6 credits)
Prerequisite: Admissions test for first year courses; and permission of ARHU-Communication department. Repeatable to 8 credits if content differs.
Develops a systematic, reflective approach to translation involving both the written and spoken word. Provides an overview of domains of translation, associated text categories and translation tasks. Develops strategies to identify, analyze and resolve translation challenges in specific, authentic,real-world contexts. Working with a series of current texts, explores general translation concepts and language-specific strategies. Includes sight translation exercises and introduction to translation resources and computer tools used in the translators workplace.

COMM 641 Introduction to Computer-Assisted Translation (1 credits)
Prerequisite: Admissions test for first year courses; and COMM639; and permission of ARHU-Communication department.
Introduces the use of computer-assisted translation tools to support large-scale translation projects and streamline translation processes. Focuses on industry software products that utilize translation memory and terminology management systems. Discusses the role of tools in the entire translation process from pre- to post-editing.

COMM 649 Translation for Specific Domains (2-6 credits)
Prerequisite: Admissions test for first year courses; and COMM639; and permission of ARHU-Communication department. Repeatable to 8 credits if content differs.
Builds upon the systematic, reflective approach introduced in Fundamentals of Translation by addressing the development of translation skills required for specialization in specific domains. In written and sight translation exercises include researching specialized subject material, developing and maintaining terminology, and consulting experts in the field. Includes authentic, real-world translation projects in translation teams. Overview of computer-assisted translation tools and continued work on sight translation enable higher levels of productivity under time constraints.

COMM 652 Contemporary Rhetorical Theory (3 credits)
Formerly: SPCH652.
A study of twentieth century theories of rhetoric. Special attention will be devoted to Richard Weaver, Kenneth Burke, Lloyd Bitzer, Ernest Bormann, Walter Fisher, and the continental theorists of communication such as Chaim Perelman and Jurgen Habermas.

COMM 655 Seminar in Speechwriting (3 credits)
Formerly: SPCH655.
Theoretical and practical aspects of speechwriting at an advanced level.

COMM 657 Professional Practice Forum in Interpreting: Career Portfolio and Exams (1 credits)
Prerequisite: COMM719, COMM769, and COMM729; and admissions test for second-year courses; and permission of ARHU-Communication department.
Serves as final preparation for entry into the profession through development of strategies for gaining work as a professional translator. Prepares participants for degree examinations and employer tests through the review of previous exam material and employer testing requirements. Serves as venue for degree examinations, career goal setting and planning for future employment. Participants present and defend career portfolio and summative requirement for degree.

COMM 659 Translation for Language-Specific Markets (1-3 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department.

Repeatable to 8 credits.
Builds translation skills to a highly professional level by developing autonomy in completing authentic, real-world translation projects based upon the reflective approach developed in the first-year curriculum. Develops one or more specializations. Completion of individual and group projects covering all aspects of professional translation from subject matter research, terminology work, and use of computer-assisted translation tools. Sight translation and timed exercises to increase production and meet deadlines.

COMM 661 Communication and Social Change (3 credits)
Place of rhetoric as the union of the moral and historical in moments of social definition. Reviews theories of discourse in social change including political change, social movements, consciousness change, and more global change. Application to contemporary change.

COMM 668 Risk Communication (3 credits)
Prerequisite: Permission of ARHU-Communication department. Repeatable to 9 credits if content differs.
Principles and approaches to risk communication. Emphasis is placed on theoretical trends in risk communication and application to industry. Topics include how to be an effective source of risk communication, understanding audiences, handling the media and designing messages.

COMM 669 Professional Practice Forum in Translation: Practicum (1-3 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department. Repeatable to 9 credits if content differs.
Provides opportunities to complete real-world translation projects on campus and in the public service, legal, business, and political communities as translators, project managers and translators/reviewers working on group projects. Collaboration with participants in the interpreting practicum is also sought to prepare multilingual texts for practicum events and familiarize participants with conference translation. Complements Translation for Specific Markets, and practicum projects are included in course and career reflective practice portfolios. Requires independent study plan agreed with course instructor.

COMM 670 Seminar in Listening Behavior (3 credits)
Prerequisite: COMM470; or permission of instructor. Formerly: SPCH670.
A study of research in and measurement of listening behavior.

COMM 679 Professional Practice Forum in Translation: Workplace Processes and Procedures (1 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department. Repeatable to 3 credits if content differs.
Provides in-depth exploration of processes and procedures in public service, legal, and political settings requiring translation services. Prepares for translation in real-world settings by discussing procedures across sectors and institutions, enabling informed career plans and choices. Discusses ethics, professional conduct and business practices. Reinforces identity as a professional translator, develops specializations, and pursues professional and career development opportunities through interaction with members of the profession, professional organizations, and institutions in the language industry.

COMM 680 Communication Programs in Education and Training (3 credits)
Formerly: SPCH680.
An analysis of instructional development in communication. Instructional objectives, strategies and evaluation are applied to educational, corporate and industrial training programs.

COMM 681 Communication Issues in Human Resource Development (3 credits)
Formerly: SPCH681.
Research in and theory of contemporary communication issues in the human resource development of governmental, corporate, business organizations.

COMM 683 Intercultural Communication Theory (3 credits)
An in-depth coverage of the essential theories of intercultural communication is provided.

COMM 686 Teaching Communication (1 credits)
Formerly: SPCH686.
Principles of effective teaching--content and process--in the college communication classroom.

COMM 687 Professional Development in the Communication Discipline (1 credits)
Knowledge and skills required for advancement as an academic professional in the communication discipline. Topics include types of academic institutions and posts, elements of academic performance, documentation of professional qualifications, how academic posts are secured, processes associated with tenure and promotion, processes of academic publication and history of the discipline.

COMM 688 Communication Field Experience (1-6 credits)
Restriction: Permission of instructor. Formerly: SPCH688.
Applications of communication principles and research in professional communication settings.

COMM 698 Special Problems in Communication (1-3 credits)
Formerly: SPCH698.

COMM 700 Introduction to Graduate Study in Communication (3 credits)
Restriction: Must be in Communication (Doctoral) program. Formerly: SPCH700.
Basic skills in communication research.

COMM 701 Quantitative Methods in Communication Research (3 credits)
Prerequisite: COMM700. Formerly: SPCH701.
Logic and methods of quantitative data collection and statistical analysis as applied to communication studies. Research strategies for communications: experimentation, survey research, field research, and content analysis.

COMM 702 Intermediate Quantitative Data Analysis in Communication Research: The General Linear Model (3 credits)
Prerequisite: COMM700; or permission of instructor. Formerly: SPCH702.
Data analysis in current communication research. Techniques include regression, correlation, factor analysis, matrix algebra, covariance structure, and path diagrams. Students will be expected to have completed a methods course and a statistics course or tested equivalent competencies.

COMM 703 Advanced Quantitative Data Analysis in Communication Research: Structural Equation Models (3 credits)
Prerequisite: COMM702. Restriction: Permission of instructor. Formerly: SPCH703.
Model evaluation and theory construction in communication research. Causal systems in current communication research: recursive, nonrecursive, and unobserved variable models. Students must have a dissertation research project requiring quantitative methods.

COMM 710 Translation and Localization Project

Management (3 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department.
Introduces basic principles of project management in the translation industry based upon globalization and localization processes for software, websites, and other translation-driven products. Focuses on information technology and workflow in large-scale multilingual projects. Examines planning, execution, and evaluation processes grounded in best practices and standards of the translation and localization industry.

COMM 711 Historical/Critical Methods in Communication Research (3 credits)
Prerequisite: COMM700; or permission of instructor. Formerly: SPCH711.
Methods for historical and critical research in communication. Formulation of significant research questions, systematic collection of bibliographic and phenomenal information, formulating substantial claims, organizing and writing research for disciplinary outlets.

COMM 712 Advanced Historical/Critical Methods in Communication Research (3 credits)
Prerequisite: COMM711. Restriction: Permission of instructor. Formerly: SPCH712.
Critical assessment of qualitative approaches to communication. Introduction to significant schools of historical and critical research. Advanced techniques for inquiry and manuscript preparation. Students must have dissertation research project requiring historical or critical method.

COMM 713 Translation Technology (3 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department.
Builds upon the principles outlined in Introduction to Computer-Assisted Translation to develop comprehensive knowledge of the current and future roles of technology in translation processes involving both the spoken and the written word, including use of widely available software tools and systems for terminology management, translation memory, and machine translation. Students carry out projects using translation technology, enabling them to apply newly acquired knowledge in applied contexts. Examination of case studies highlights how translation technology is leveraged across public and private sector organizations and the latest developments in the field.

COMM 714 Introduction to Qualitative Methods in Communication Research (3 credits)
Restriction: Permission of instructor.
Methods for field research in communication including interiewing, ethnographic and participant intervention, focus groups, and content analysis. Formulation of significant research questions, systematic collection of field data, formulating substantial claims from the research, organizing and writing research from disciplinary outlets.

COMM 715 Advanced Qualitative Methods in Communication Research (3 credits)
Prerequisite: COMM714; or students who have taken courses with comparable content may contact the department.
Advanced data analysis of qualitative data in Communication research. In-field research and techniques for analysis of data from in-field work.

COMM 718 Practicum in Research Proposal and Design (3 credits)
Repeatable to 6 credits. Credit only granted for: COMM718 or JOUR632. Formerly: JOUR632.
Development of research proposal through research team interaction. In different semester the course focuses on different subdisciplines of communication.

COMM 719 Advanced Consecutive Interpretation (2-6 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department.
Builds consecutive interpreting skills to a highly professional level by sharpening listening, processing, memory, note-taking, and delivery skills, enabling interpretation of highly complex material requiring particular attention to nuance, tone, and style. Includes dialogue and monologue interpreting exercises with specialized subject material. Participants emerge from the course as reflective practitioners with the simultaneous interpreting skills required to perform competently in real-world settings.

COMM 720 Seminar in Small Group Communication (3 credits)
Formerly: SPCH720.
Small group communication theory, research, and applications.

COMM 724 Seminar in Organizational Communication (3 credits)
Restriction: Permission of instructor. Formerly: SPCH724.
Theories and problems of human communication within, between, and/or among formal organizations will be emphasized.

COMM 729 Simultaneous Interpretation (1-3 credits)
Prerequisite: Admissions test for second year courses; and permission of ARHU-Communication department.
Builds upon the discussion of the simultaneous mode and exercises in Introduction to Simultaneous Interpreting by reviewing the relationship between consecutive and simultaneous skills and introducing work in the booth in a series of progressive exercises. Addresses challenges such as coordination of split attention, ear-voice span, memory and delivery / presentation. Reinforces principles of collegial teamwork and good microphone technique in the booth. Enhances preparation skills required for interpretation of specialized subject matter.

COMM 730 Seminar in Health Communication (3 credits)
Formerly: SPCH730.
Communication processes in health care and promotion.

COMM 738 Seminar in Mediated Communication (3-12 credits)
Restriction: Permission of instructor. Repeatable to 12 credits if content differs.
The examination of special topics related to the study of mediated communication.

COMM 739 topics in Public Relations (3 credits)
Repeatable to 6 credits if content differs. Formerly: JOUR739.
Seminar on specialized areas of scholarly research in public relations or on the practice of public relations in specialized organizational settings.

COMM 748 The Rhetoric of the Presidency (3 credits)
Repeatable to 9 credits if content differs. Credit only granted for: COMM748 or COMM768. Formerly: COMM768.
The study of the historical and contemporary rhetoric of the presidency in appropriate historical and political contexts. Scholarship related to public address studies and theories of the presidency will be featured.

COMM 749 Advanced Simultaneous Interpretation (1-3 credits)
Prerequisite: COMM729; and admissions test for second-year courses; and permission of ARHU-Communication department. Repeatable to 4 credits if content differs.
Builds simultaneous interpreting skills to a highly professional level, including highly complex material requiring particular attention to nuance, tone, and style. Resolves any remaining challenges of

split attention, ear-voice span, memory and delivery / presentation. Introduces simultaneous interpretation with text, based upon sight translation techniques. Participants emerge from the course as reflective practitioners with the simultaneous interpreting skills required to perform competently in real-world settings.

COMM 758 Seminar in Rhetorical Theory (3 credits)
Prerequisite: COMM460, COMM461, or COMM450. Repeatable to 12 credits if content differs. Formerly: SPCH758.
Examination of selected theories of style drawn from the fields of rhetoric and literature, and analysis of model speeches.

COMM 759 Professional Practice Forum in Interpreting: Practicum (1-3 credits)
Prerequisite: Admissions test for second-year courses; and permission of ARHU-Communication department. Repeatable to 9 credits if content differs.
Provides opportunities to interpret consecutively and simultaneously in real-world settings on campus and in the public service, legal, business, and political communities. Develops team leader skills by organizing and convening an event or series of events (conference, debate, or negotiation), selecting topics and delegates, and preparing speeches and arguments to deliver and interpret. Collaboration with participants in M.A. translation courses is sought. Requires independent study plan agreed with course instructor.

COMM 760 Seminar in Political Communication (3 credits)
Formerly: SPCH760.
A blend of theory and practice to integrate rhetorical-critical theory and empirical methods with politics. Practitioners in political communication will be drawn in as resource persons. Students will map the communication strategy for candidates and analyze actual campaign strategies.

COMM 762 The Rhetoric of Political Institutions (3 credits)
The role of discourse in major political institutions is examined. The specific institutional focus may change from instructor to instructor. Examples include Congress, the courts, or the state legislatures.

COMM 768 Seminar in Public Address (3 credits)
Repeatable to 12 credits if content differs. Formerly: SPCH768.
An in-depth study of national and international speakers and issues throughout the history of the spoken word. Emphasis will be placed upon the application of rhetorical principles to the analysis of world speakers and their speeches.

COMM 769 Professional Practice Forum in Interpreting: Workplace Processes and Procedures (1-2 credits)
Prerequisite: Admissions test for second-year courses; and permission of ARHU-Communication department. Repeatable to 3 credits if content differs.
Provides in-depth exploration of processes and procedures in public service, legal, and political settings where interpreting services are commonplace. Enables students to make informed career plans and choices. Empowers participants by helping to establish and reinforce identity as a professional interpreter, develop specializations, and pursue professional and career development opportunities through interaction with members of the profession, professional organizations, and institutions in the language industry.

COMM 775 Seminar in Persuasion and Attitude Change (3 credits)
Prerequisite: Permission of ARHU-Communication department. Formerly: SPCH775.
This seminar will concentrate on the problem of making message strategy decisions. Course content will consist of study of both theoretical and empirical research on attitude and attitude change in persuasive communication.

COMM 776 Seminar in Interpersonal Communication (3 credits)
Formerly: SPCH776.
Interpersonal communication theory, research, and practice.

COMM 777 Persuasive Message Strategies (3 credits)
Credit only granted for: COMM698P or COMM777. Formerly: COMM698P.
Examines which persuasive messages are effective to change attitudes and behavior at what times and with what people.

COMM 779 Seminar: Special Topics in Persuasion and Attitude Change (3 credits)
Recommended: COMM775. Repeatable to 9 credits if content differs.
This seminar explores special topic areas with the study of persuasion and attitude change, such as social cognition, humor, message production,and cognitive oscillation.

COMM 783 Seminar in Intercultural Communication (3 credits)
Credit only granted for: COMM682 or COMM783. Formerly: COMM682.
Concentrates on theoretical and methodological issues in intercultural communication research.

COMM 789 Seminar: Special Topics in Intercultural Communication (3 credits)
Recommended: COMM683. Repeatable to 9 credits if content differs.
Explores special topic areas within the study of intercultural communication, such as culture and conflict, intercultural negotiation, cross-cultural relationships.

COMM 798 Independent Study (1-3 credits)
Restriction: Permission of instructor. Formerly: SPCH798.
An individual course designed for intensive study or research of problems in communication.

COMM 799 Master's Thesis Research (1-6 credits)
Formerly: SPCH799.

COMM 879 Special Research Problems in Persuasion and Attitude Change (1-4 credits)
Prerequisite: Permission of ARHU-Communication department. Repeatable to 9 credits if content differs.
Directed team and individual research projects.

COMM 888 Doctoral Practicum in Communication (3-9 credits)
Repeatable to 9 credits if content differs. Formerly: SPCH888.
Analysis of professional activity through personal observation. Evaluation of the purpose, process, effectiveness, and efficiency of professional activity. Recommendations for training and further research.

COMM 889 Doctoral Tutorial in Communication (3-9 credits)
Repeatable to 9 credits if content differs. Formerly: SPCH889.
Individual research in communication.

COMM 898 Pre-Candidacy Research (1-8 credits)

COMM 899 Doctoral Dissertation Research (1-8 credits)
Formerly: SPCH899.

Sustainable Development &

Conservation Biology (CONS)

CONS 608 Seminar in Sustainable Development and Conservation Biology (1-4 credits)
Repeatable to 6 credits if content differs.
Special topics and current literature in conservation biology and sustainable development.

CONS 609 Special Topics in Conservation Biology (1-3 credits)
Repeatable to 6 credits if content differs.
Lectures, experimental courses and other special instructions in various subjects in conservation biology.

CONS 670 Conservation Biology (3 credits)
Also offered as: MEES670. Credit only granted for: CONS670 or MEES670.
Conservation in the Anthropocene means conserving biodiversity and ecosystem function in the midst of climate change, habitat loss, overexploitation, altered nutrient cycling, and invasive species with protected areas and reserve networks, ecosystem restoration, and other biodiversity conservation and management schemes.

CONS 680 Problem Solving in Conservation/Development (4 credits)
Students will be exposed to current problems in conservation and development through great lectures, field trips, interviews and appropriate literature. Working in teams, students will formulate recommendations based on a synthesis of biological, economic and policy considerations.

CONS 798 Research Papers in Sustainable Development and Conservation Biology (1-4 credits)
Restriction: Must be in Sustainable Development & Conservation Biology (Master's) program. Repeatable to 4 credits if content differs.
Work on the required scholarly paper.

Dance (DANC)

DANC 405 Dance Education and Policy (3 credits)
Restriction: Permission of ARHU-Dance department.
Curricula in dance in K-12 settings, classroom management, assessment/grading, and best practices in dance education in public schools. Current research and policy issues are included. This course counts towards teacher certification in the State of Maryland.

DANC 409 Contact Improvisation (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 4 credits. Credit only granted for: DANC489C or DANC409.
Discovery and cultivation of the principles and skills of Contact Improvisation dance technique.

DANC 410 Technical Theater Production for Dance (3 credits)
Prerequisite: DANC210; or students who have taken courses with comparable content may contact the department; or permission of ARHU-School of Theatre, Dance & Performance Studies department.
A study of the theoretical principles of production and the practical application of those principles to the presentation of dance works.

DANC 420 Partnering (2 credits)
Restriction: Permission of ARHU-Dance department.
Elements of contemporary partnering including weight sharing, counter balancing, momentum/leverage, lifting and moving responsively.

DANC 428 Advanced Ballet Technique I (1 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 3 credits.
Advanced ballet technique with emphasis on physical and expressive skills.

DANC 429 Advanced Ballet Technique II (1 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 3 credits.
Intensive work in ballet technique for the professionally-oriented dancer.

DANC 448 Modern Dance V (3 credits)
Prerequisite: DANC349; and must audition. Repeatable to 6 credits.
Complex phrases of modern dance movement with emphasis on articulation and expression.

DANC 449 Modern Dance VI (3 credits)
Prerequisite: DANC448; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Continuation of DANC448.

DANC 466 Laban Movement Analysis (3 credits)
Introduction to Rudolf Laban's system of qualitative movement analysis in relation to understanding personal movement style. Application to dance performance, teaching, composition and research.

DANC 468 Modern Repertory (3 credits)
Prerequisite: DANC349; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits if content differs.
Form, content, music, design and performance of modern dance works.

DANC 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

DANC 479 Advanced Practicum in Dance (1-3 credits)
Repeatable to 6 credits.
Advanced level performing experience for the student dancer who has developed an advanced professional level of competence.

DANC 483 History of Dance II (3 credits)
Prerequisite: DANC200.
The development of dance from the Renaissance period to the present time and the relationship of dance forms to patterns of culture.

DANC 485 Seminar in Dance (3 credits)
Prerequisite: DANC483. Restriction: Must be in Dance program; and senior standing.
Individual research leading to a presentation with written documentation of the process, serving as a culmination of undergraduate study for dance majors.

DANC 488 Project-Based Learning (4 credits)
Restriction: Permission of ARHU-Dance department.
A specific project, is addressed, in dance from the perspectives of the investigator, the creator/choreographer, and the performer. Projects are cross-disciplinary and/or cross-cultural, and may involve both on- and off-campus experiences.

DANC 489 Special Topics in Dance (1-3 credits)
Restriction: Permission of ARHU-

School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits if content differs.
Theoretical, choreographic, pedagogic, or performance study.

DANC 499 Practicum in Choreography, Production and Performance IV (1-6 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Advanced workshop in dance presentation, including performing, production and planned field experiences.

DANC 600 Introduction to Graduate Studies in Dance (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Supervised writing of reports and articles on selected dance subjects. Study of library resources and interviewing techniques. Preparation for written documentation of thesis project.

DANC 604 Dance Pedogogy (2 credits)
Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance Studies department.
Curriculum writing, lesson planning, class structure, assessment/grading, and practice in dance pedagogy. Includes preparation of syllabi and studio teaching practice. This course counts towards teaching ceritification in the State of Maryland.

DANC 605 Seminar: Dance in Higher Education (2 credits)
Overview of program planning, curriculum development, promotion and tenure and other issues in higher education in the field of dance.

DANC 608 Choreography I (3-6 credits)
Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Developing and defining individual choreographic voice and vision in a shared studio setting.

DANC 610 Workshop in the Direction of Dance Production (3 credits)
Prerequisite: DANC410; or students who have taken courses with comparable content may contact the department.
A lecture/laboratory course dealing with the relationship of the director to all of the activities involved in the presentation of a dance concert.

DANC 611 Dance Technology and Media (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Project-based development of media and technological support for dance performance, archiving, and portfolio design, development and implementation.

DANC 647 Movement Practice (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Experiential studio work that generates common movement vocabulary and innovations of same in a shared, faculty-led exploration of movement for the purpose of generating vocabulary for technique, choreography, and pedagogy.

DANC 648 Advanced Modern Dance Technique I (2 credits)
Prerequisite: DANC449; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits.
Professional level training in contemporary dance techniques.

DANC 649 Advanced Modern Dance Technique II (2 credits)
Prerequisite: DANC648; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits.
A continuation of DANC 648.

DANC 678 Individual Movement Practice (2 credits)
Prerequisite: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 10 credits.
Students in consultation with the adviser, propose a specific movement practice and can select the practice from the range of technique offerings in the program. Additional work in documenting and providing evidence of growth towards individual outcomes is required.

DANC 679 Graduate Dance Performance (1-3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
An advanced performance course focusing on the restagings from noted scores of the choreographic works of significant artists in the field.

DANC 689 Special Topics in Dance (1-6 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 12 credits if content differs.
Special Topics in dance theory, research or creative projects.

DANC 698 Independent Study in Dance (1-3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Directed independent study in theoretical topics.

DANC 705 Arts Education (3 credits)
History of arts education in the U.S., recent policy changes and trends, current and recent research findings, proposed legislation at the state and federal level and the relationship of research designed to, in part, prepare students to be K-12 arts education and/or researchers and/or policy professionals.

DANC 708 Choreography II (3-6 credits)
Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Collaborative work across disciplines and genres.

DANC 719 Choreographic Project (3 credits)
Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Research-based choreographic projects in preparation for the choreographed thesis project.

DANC 766 Movement Observation and Analysis (2 credits)
Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance Studies department.
Aspects of cultural and nonverbal analysis, developmental movement, kinesiological analysis, Laban Movement Analysis, with the goal of developing the student/teacher's ability to observe macro and micro levels of detail.

DANC 777 Internship in Dance (6 credits)
Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance

Studies department.
Internship in dance advocacy, administration, education, community building, choreography, or performance with an agency off campus and with a national or international profile.

DANC 779 Master's Tutorial for Performance (1-3 credits)

Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Supervised performance experience for advanced dancers.

DANC 784 Dance in a Global Context (3 credits)

Restriction: Must be admitted to MFA in Dance; or permission of ARHU-School of Theatre, Dance & Performance Studies department.
Topics that illuminate dance in global context and provides an overview of methods, challenges and perspectives to the study of dance cross-culturally will be considered. Simultaneously, surveys select dance practices spanning many geographical areas, and offers insight into the diverse social, cultural, religious, and political environments from which dance extends.

DANC 788 Master's Tutorial for Choreography (1-3 credits)

Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Supervised production and presentation of a significant choreographic project.

DANC 789 Directed Study in Dance Theory (2-6 credits)

Repeatable to 6 credits if content differs.
Advanced directed study in dance history, theory or criticism culminating in a paper for presentation or publication.

DANC 799 Master's Thesis Project (1-6 credits)

Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.

Economics (ECON)

ECON 401 Current Issues in American Economic Policy (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (ECON321, STAT400); and minimum grade of C- in ECON325 and ECON326. Restriction: Must be in a major within the BSOS-Economics department.
Analysis of current economic problems and public policies. Topics include increasing competitiveness, mitigating poverty, addressing harmful effects of income inequality, promoting environmental sustainability, and facilitating economic stability and growth.

ECON 402 Macroeconomic Models and Forecasting (3 credits)

Prerequisite: Minimum grade of C- in ECON325; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Analysis of the fluctuations in economic activity and the formulation and use of forecasting models of the economy. Illustrations of computer macro models and forecasting problems.

ECON 407 Advanced Macroeconomics (3 credits)

Prerequisite: Minimum grade of C- in ECON325; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
An in-depth analysis of current issues in macroeconomic theory and policy. Topics covered include: 1. alternative perspectives on macroeconomics including monetarism, new classical equilibrium models, rational expectations, and real business cycle models; 2. long term growth, the slowdown in productivity growth, and concerns about U.S. competitiveness; 3. the effectiveness of macroeconomic policy in an open economy; 4. the effects of finance on the real sector.

ECON 412 Economic History and Modern Development (3 credits)

Prerequisite: Minimum grade of C- in ECON325 and ECON326. Restriction: Must be in a major within the BSOS-Economics department.
Analysis of major economic, political, and social change in the developed world since 1800. This includes factors contributing to increases in economic performance, changes in the form of government, technological change (including industrialization), and integration and disintegration of the global economy. Emphasis is on institutional changes in how societies organize economic and political activities.

ECON 413 Information and Markets (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Presents advanced microeconomic theory, concentrating on how information affects exchange and market outcomes, including insurance, signaling, reputations, and incentive contracts. Studies applications to various markets and policy questions.

ECON 414 Game Theory (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department. Credit only granted for: CMSC474, ECON414, GVPT399A or GVPT390.
Studies the competitive and cooperative behavior that results when several parties with conflicting interests must work together. Learn how to use game theory to analyze situations of potential conflict. Applications are drawn from economics, business, and political science.

ECON 415 Market Design (3 credits)

Prerequisite: Minimum grade of C- in ECON414; or permission of BSOS-Economics department. Restriction: Must be in a major within the BSOS-Economics department.
Most decisions are not made in isolation, but involve interaction with others. Applies the foundations of game theory learned in ECON414 to several important topics in business and economics. Emphasis is on topics of practical importance: negotiation, markets with few participants, pricing and incentives.

ECON 416 Theory of Economic Development (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department. Credit only granted for: ECON315 or ECON416.
Economic theory of the developing nations; role of innovation, capital formation, resources, institutions, trade and exchange rates, and governmental policies.

ECON 418 Economic Development of Selected Areas (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (ECON325, ECON326); and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department. Repeatable to 6 credits if content differs.
Economic and institutional characteristics of a specific geographic area are identified and discussed, and alternate strategies and policies for development are analyzed.

ECON 422 Econometrics I (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (ECON325, ECON326); and 1 course with a minimum grade of C- from (STAT400, ECON321). Restriction: Must be in a major within the BSOS-Economics department. Credit only granted for: ECON422, AREC422, or AREC489F.
Emphasizes the interaction between economic problems and the assumptions employed in statistical theory. Formulation, estimation, and testing of economic models, including single variable and multiple variable regression techniques, theory of identification, and issues relating to inference.

ECON 423 Econometrics II (3 credits)
Prerequisite: ECON422. Restriction: Permission of BSOS-Economics department.
Interaction between economic problems and specification and estimation of econometric models. Topics include issues of autocorrelation, heteroscedasticity, functional form, simultaneous equation models, qualitative choice models, and other computational methods.

ECON 424 Computer Methods in Economics (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (ECON325, ECON326); and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Database development from Internet and other sources, research methods, and statistical analysis in economics using EXCEL and SAS.

ECON 425 Mathematical Economics (3 credits)
Prerequisite: Minimum grade of C- in ECON325 and ECON326. Restriction: Must be in a major within the BSOS-Economics department; or must be in a major within the CMNS-Mathematics department.
Mathematical developments of theory of household and firm, general equilibrium and welfare economics, market imperfections, and role of information.

ECON 426 Economics of Cost-Benefit Analysis (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (ECON325, ECON326); and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department. Credit only granted for: ECON398A or ECON426. Formerly: ECON398A. Additional information: ECON426 meets the major requirement for Quantitative and Analytic Reasoning.
Study of how to use cost benefit analysis and other similar tools of applied microeconomics to conduct policy analyses. Cost-benefit analysis is an empirical method of identifying an optimal choice from a set of policy alternatives, where optimal is defined in terms of economic efficiency. Real world examples are addressed, so that students understand limitations of the methods and also interactions of economic analysis with political and administrative processes.

ECON 427 Experimental Economics (3 credits)
Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department. Credit only granted for: ECON398X or ECON427. Formerly: ECON398X.
An introduction to the methodology of experimental economics and its application to issues such as decision-making under uncertainty, auctions, and public goods. Also an introduction to behavioral economics as a relatively new area of economic research.

ECON 435 Financial Markets and the Macroeconomy (3 credits)
Prerequisite: Minimum grade of C- in ECON325 and ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department; and must not have completed BMGT343. Credit only granted for: BMGT343 or ECON435. Additional information: Finance majors will not receive credit for ECON435.
The different types of financial assets that exist, the markets that they trade in, and the determination of their prices and rates of return are examined. Specific topics that will be covered include the Markowitz portfolio selection model, the capital asset pricing model, the arbitrage pricing theory, the efficient markets hypothesis, the term structure of interest rates, and options. There will be almost no emphasis on issues in corporate finance.

ECON 441 Theory of International Economics (3 credits)
Prerequisite: Minimum grade of C- in ECON326 and ECON325. Restriction: Must be in a major within the BSOS-Economics department; and must not have completed ECON340, ECON442, or ECON443. Credit only granted for: ECON340, ECON441, ECON442, or ECON443.
Theoretical treatment of international trade and international finance. Includes Ricardian and Heckscher-Ohlin theories of comparative advantage, analysis of tariffs and other trade barriers, international factor mobility, balance of payments adjustments, exchange rate determination, and fiscal and monetary policy in an open economy.

ECON 442 Globalization and Capital Markets (3 credits)
Prerequisite: Minimum grade of C- in ECON326 and ECON325; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department; and must not have completed ECON441. Credit only granted for: ECON441 or ECON442.
Uses models of open-economy macroeconomics to explain the causes and consequences of international capital flows. Analysis is made of private consumption, investment, the government sector, current accounts, the labor market, and the money and foreign exchange markets in small open economies. This framework is then used to study examples of how speculative attacks on currencies, sudden reversals of capital inflows, and the effects of the lack of credibility of economic policy affect economic development.

ECON 443 International Trade and Trade Policy in the New Global Economy (3 credits)
Prerequisite: Minimum grade of C- in ECON326 and ECON325. Restriction: Must be in a major within the BSOS-Economics department; and must not have completed ECON441. Credit only granted for: ECON441 or ECON443.
Examines the economics of international economic integration, including the theory of customs unions and free trade areas, the role of GATT and the WTO, changes in individual countries' foreign trade policies during the new era of globalization, the special role of multinational firms in world trade, and recent controversies about the benefits and costs of globalized trade.

ECON 451 Public Choice (3 credits)
Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Analysis of collective decision making, economic models of government, program budgeting, and policy implementation; emphasis on models of public choice and institutions which affect decision making.

ECON 454 Public Finance and Public Policy (3 credits)
Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a

major within the BSOS-Economics department. Credit only granted for: ECON350 or ECON454.
Study of welfare economics and the theory of public goods, taxation, public expenditures, benefit-cost analysis, and state and local finance. Applications of theory to current policy issues.

ECON 456 Law and Economics (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Relationship of the exchange process to the system of institutions and rules that society develops to carry out economic transactions. Topics covered include: Property rights; torts, negligence, and liability; contracts and exchanges; criminal control and enforcement; equity and efficiency issues .

ECON 458 Special Topics in Study Abroad IV (1-6 credits)

Prerequisite: At least one intermediate theory course and/or statistics. Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

ECON 460 Industrial Organization (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Examines different theoretical models of firm behavior in markets with varying amounts of market power. Relates theory to specific industries and examines how market structure evolves over time.

ECON 461 Economics of Regulation and Anti-trust (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Considers government intervention in economic activity of three types: antitrust policy, regulation of natural monopolies, and health safety regulation. Covers theoretical models, real-world policy applications, and empirical studies relevant to the impact of regulation.

ECON 465 Health Care Economics (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
Analysis of health care, the organization of its delivery and financing. Access to care; the role of insurance; regulation of hospitals, physicians, and the drug industry; role of technology; and limits on health care spending.

ECON 468 Special Topics in Applied Economics (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (BMGT230, ECON230); and 1 course with a minimum grade of C- from (ECON305, ECON306). Restriction: Must be in Economics program. Repeatable to 15 credits if content differs.
Selected topics in applied economics. Designed to meet the changing interests of students and staff.

ECON 470 Labor Economics:Theory and Evidence (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department.
An analytical treatment of theories of labor markets, and an examination of empirical findings, evidence and conclusions. Topics covered will include some or all of the following: labor demand; labor supply and labor market participation; theory of human capital; earnings differentials; and if time allows, market structure and the efficiency of labor markets; and unemployment.

ECON 480 Seminar in the New Economy (3 credits)

Prerequisite: Minimum grade of C- in ECON325 and ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Corequisite: ECON422 or ECON424. Restriction: Must be in a major within the BSOS-Economics department; and permission of BSOS-Economics department.
Five to six research topics corresponding to the current research programs of different Economic Department faculty members will be examined. Students will be expected to prepare reflections on each topic and culminate with a research proposal of their own.

ECON 481 Theory and Policy in Environmental Economics (3 credits)

Prerequisite: Minimum grade of C- in ECON326; and 1 course with a minimum grade of C- from (ECON321, STAT400). Restriction: Must be in a major within the BSOS-Economics department; or must be in a major in AGNR-Dean-Environmental Science & Policy Program.
Application of economic theory and empirical tools to the analysis of environmental issues. The concepts of externalities, public goods, property rights and cost-benefit analysis are applied to air pollution, water pollution, solid waste management, hazardous waste, and global warning. The optimal role and various tools of public policy are addressed.

ECON 490 Urban & Regional Economics: Issues and Policies (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (ECON321, BMGT230, ECON230); and 1 course with a minimum grade of C- from (ECON306, ECON326, AREC326). Restriction: Must be in a major within the BSOS-Economics department. Credit only granted for: ECON398I or ECON490. Formerly: ECON398I.
Exploration of urban and regional economics and policies, including economic forces leading to formation of city and regional networks. Conceptual and empirical analysis of policies affecting land use, housing, transportation and other aspects of sub-national economic development.

ECON 498 Special Topics in Economic Analysis (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (ECON321, STAT400); and 1 course with a minimum grade of C- from (ECON325, ECON326). Restriction: Must be in Economics Bachelor of Science program. Repeatable to 15 credits if content differs.
Selected topics in economic analysis. Designed to meet the changing interests of students and staff.

ECON 601 Macroeconomic Analysis I (3 credits)

Restriction: Permission of BSOS-Economics department.
Introductory technical treatment of standard Keynesian, classical and new classical macroeconomic models. Expectations formation and microeconomic foundations of consumption, investment, money demand, and labor market behavior.

ECON 602 Macroeconomic Analysis II (3 credits)

Prerequisite: ECON601; or permission of BSOS-Economics department.
Further issues regarding macroeconomic topics. First half emphasis will be placed on dynamic macroeconomic theory as pertaining to monetary issues, policy ineffectiveness and effectiveness. The second half of the course will focus on theories of investment and growth.

ECON 603 Microeconomic Analysis I (3 credits)
Restriction: Permission of BSOS-Economics department.
A detailed treatment of the theory of the consumer and of the firm, particularly emphasizing the duality approach. Topics include the household production model, imperfect competition, monopolistic and oligopolistic markets.

ECON 604 Microeconomic Analysis II (3 credits)
Prerequisite: ECON603. Restriction: Permission of BSOS-Economics department.
Analysis of markets and market equilibria; the Arrow-Debreu model of general equilibrium, the two-sector model, welfare theorems, externalities, public goods, markets with incomplete and asymmetric information.

ECON 611 Seminar in American Economic Development (3 credits)
Restriction: Permission of BSOS-Economics department.
Selected topics in the long-term movements of the American economy. Quantitative studies of the growth of output; applications of econometric methods and economic theory to topics in American economic history.

ECON 613 Origins and Development of Capitalism (3 credits)
Restriction: Permission of BSOS-Economics department; and must not be an advanced special student.
Institutions and technology shaping pre-capitalist economies: Archaic, Greek and Roman, Feudal, and Mercantile. Rise of the market system, national economies, and capitalism. The nature of industrial society. Imperialism.

ECON 615 Development Economics I (3 credits)
Prerequisite: ECON603; or permission of BSOS-Economics department.
Explore both the causes and consequences in development economics from a historical and scientific approach. Presents theoretical models and applied work that test alternative hypotheses. Explore models of economic growth and institutions, with emphasis on property rights and political regimes as causal factors affecting development. Discuss empirical methods widely used in the field and important related topics including poverty, inequality, education and health.

ECON 616 Economic Development II (3 credits)
Prerequisite: ECON615, ECON603, and ECON604; or permission of BSOS-Economics department.
Survey of a variety of models explaining how market failures may lead to poverty and underdevelopment, with an emphasis on the empirical evaluation of constraints faced by individuals in developing countries and the programs that attempt to alleviate those constraints. Topics include: agricultural and land markets, labor markets, human capital in developing countries, credit markets, and consumption smoothing and risk coping.

ECON 621 Quantitative Methods I (3 credits)
Prerequisite: ECON600; or permission of BSOS-Economics department.
An introduction to econometrics, and a development of the mathematical background concepts needed. Background materials relate to various topics in linear algebra, and in distribution theory. Focus on estimation, hypothesis testing, and prediction in the classical linear regression model. Corresponding large sample issues are considered. Special topics such as non-nested models, hypotheses relating to nonlinear functions of parameters, and specification analysis, including tests for the dynamic stability of a model.

ECON 623 Econometrics I (3 credits)
Prerequisite: Must have advanced knowledge of probability, statistics, and linear algebra. Restriction: Permission of BSOS-Economics department.
Specification, estimation, hypothesis testing and prediction in the classical and generalized linear regression model. Topics include: ordinary least squares, generalized least squares, instrumental variableestimation, quantile regression, finite and large sample analysis and general testing principles including misspecification tests. The course will also provide instructions on the use of a major statistical packagesuch as Stata or TSP.

ECON 624 Econometrics II (3 credits)
Prerequisite: ECON623; or permission of BSOS-Economics department.
A continuation of ECON623. Topics include: Nonlinear models and nonlinear estimation methods (generalized method of moments and maximum likelihood estimation), panel data models, univariate dynamic models, multivariate dynamic models including simultaneous equation models, and non-parametric/semiparametric estimation methods. The course will also provide instructions on the use of a major statistical package such as Stata or TSP.

ECON 625 Computational Economics (3 credits)
Prerequisite: ECON604 and ECON624. Credit only granted for: ECON625 or ECON698R. Formerly: ECON698R.
An examination of the specification, computation, estimation and interpretation of structural models that are widely used in applied microeconomics (empirical and theoretical Industrial Organization, public and urban economics, environmental economics, development, political economy (e.g., voting), health and education economics, trade) and Marketing. The focus will be on how to use these models in practice, and students will solve and estimate models in weekly problem sets, with solutions/code being discussed in class.

ECON 626 Empirical Microeconomics (3 credits)
Prerequisite: ECON624. Restriction: Must be in Economics (Doctoral) program.
To provide students with the opportunity to use empirical techniques that are particularly valuable in the analysis of microeconomic data. Topics include panel data, nonlinear optimization, limited dependent variables, truncated, censored, selected samples, the analysis of natural experiments, and quantile regressions. This course will emphasize hands-on practical experience.

ECON 627 Empirical Macroeconomics (3 credits)
Prerequisite: ECON721 or ECON622; or permission of instructor.
Introduction to the solution, identification, estimation, and evaluation of macroeconomic models under rational expectations. Emphasis is on those tools that allow researchers to tightly link economic theory with econometric methods. Hands-on application of these techniques to empirical macroeconomic problems (business cycles, growth, consumption/ saving, investment), using time-series and panel data.

ECON 630 Computational Methods in Macroeconomics (3 credits)
Prerequisite: ECON602 and ECON601. Restriction: Must be in one of the following programs (Economics (Master's); Economics (Doctoral)) ; or permission of BSOS-Economics department.
Essential computational methods used in macroeconomics. There will be particular focus on approximating the solution to dynamic stochastic general equilibrium models. Methods for representative-agent and heterogeneous-agent models will be extensively studied. Econometric methods such as Generalized Method of Moments, Maximum Likelihood, Vector Autoregressions wil also be covered.

ECON 635 Experimental Economics (3 credits)
Restriction: Permission of instructor.
An introduction to the methodology of laboratory and field experiments. The course concentrates on a series of experiments to show how experiments build on one another, allowing researchers with different theoretical dispositions to narrow the range of potential disagreement.

ECON 636 Behavioral Economics (3 credits)
Prerequisite: ECON603 and ECON604; and permission of BSOS-Economics department.
An exploration of how people make decisions, questioning the concept of "perfect rationality" in the standard economic theory, providing improved models in line with the observed biases of decision makers. Focusing on decision making under risk and ambiguity, endowment effect, status quo bias, loss aversion, intertemporal choice, and selfish and pro-social preferences.

ECON 641 Microeconomic Analysis (3 credits)
Restriction: Must be in M.Prof.Studies: Applied Economics program; or permission of BSOS-Economics department. Credit only granted for: ECON641 or ECON506. Formerly: ECON506.
Microeconomic analysis applied to public policy problems with an emphasis on practical examples and how they illustrate microeconomic theories. Policy issues such as pollution, welfare and income distribution, market design, industry regulation, price controls, tax policy and health insurance are practical examples used to illustrate the abstract principles of microeconomics.

ECON 642 Topics in Applied Macroeconomics (3 credits)
Restriction: Must be in M.Prof.Studies: Applied Economics program; or permission of BSOS-Economics department.
Focus is on applied macroeconomic models used by federal agencies to explain and predict economic behavior. Course emphasizes macroeconomic data: NIPA accounts, GDP, construction and application of CPI, labor force data and economic indicators. Students will also study a selected set of current macroeconomic topics including models of economic growth, economic fluctuations, monetary policy, inflation and financial markets.

ECON 643 Empirical Analysis I: Foundations of Empirical Research (3 credits)
Credit only granted for: ECON643 or ECON521. Formerly: ECON521.
Fundamental aspects of data management and interpretation emphasizing sampling, descriptive statistics, index numbers and construction of aggregated variables. Students will learn probability theory, confidence intervals, hypothesis testing and regression analysis using the EXCEL spreadsheet program and STATA statistical software.

ECON 644 Empirical Analysis II: Introduction to Economic Models (3 credits)
Prerequisite: ECON643.
An introduction to econometric methods with applications to public policy analysis. Primary focus on application and interpretation of multiple regression analysis.

ECON 645 Empirical Analysis III: Econometric Modeling and Forecasting (3 credits)
Prerequisite: ECON644. Credit only granted for: ECON645 or ECON523. Formerly: ECON523.
Study of empirical techniques that are particularly relevant to the analysis of microeconomic models. Emphasis is on advanced panel data methods, time series regressions, instrumental variables, limited dependent variables, and sample selection corrections.

ECON 652 Public Economics I (3 credits)
Prerequisite: ECON604 and ECON624.
The characteristics and effects of government programs whose role is redistribution and social insurance are considered. Examples include cash welfare assistance, unemployment insurance, and Social Security. The focus is on U.S. programs, though other countries may be considered. Both theories of program design and empirical research on program effects will be covered. Topics in empirical methodology generally will also be stressed.

ECON 661 The Corporate Firm (3 credits)
Prerequisite: ECON604 and ECON603.
This course examines firms' strategic behavior in a variety of settings and considers theories of the firm and industrial structure. Topics may include product choice, quality, advertising, consumer search and switch costs, manufacturer-retailer relations, manufacturer-supplier relations, vertical integration, and alternative industrial structures.

ECON 662 Theories of Industrial Organization (3 credits)
Prerequisite: ECON604 and ECON603.
Classical theories of industry organization are analyzed. Topics include monopoly price discrimination, product differentiation and bundling as well as traditional oligopoly models of Cournot and Bertrand are examined. Dynamic models of oligopoly including entry deterrence and collusion are discussed in addition to games of research and development. Long-run industry structures and dynamics are also analyzed. Also investigates implications of these models for antitrust policy.

ECON 664 Empirical Studies in Industrial Organization (3 credits)
Prerequisite: ECON603, ECON604, and ECON624. Credit only granted for: ECON664 or ECON698J. Formerly: ECON698J.
Review recent empirical literature in industrial organization. Covers price discrimination, cartel and collusion, entry and market structure, information and competition, technological change and adoption, auction, and firm organization.

ECON 665 Health Economics (3 credits)
Prerequisite: Permission of BSOS-Economics department. Or ECON603; and (ECON624 or ECON621).
The determinants of health and how health care markets operate are examined by utilizing quantitative and analytic economic tools. Topics covered include: measuring health outcomes; the determinants of health; the government control of unhealthy behavior; the demand and supply of health insurance; markets for medical care; social insurance programs such as Medicare and Medicaid; the causes and consequences of medical innovation; the role of non-profits in health care; medical malpractice; covering the uninsured.

ECON 668 The Economics of Retail Systems (3 credits)
Repeatable to 6 credits if content differs.
This course is designed mainly but not exclusively for students in the third year of the economics Ph.D program and for students at a similar stage in a marketing program. Its main objective is to help the student generate their first professional research paper. In terms of interests it targets those in the area of microeconomics (advanced micro, industrial organization, or more generally applied microeconomics or micro aspects of any field). The course will be conducted as a seminar.

ECON 670 Financial Economics (3 credits)
Prerequisite: ECON641; and must have completed or be concurrently enrolled in ECON644. Restriction: Must be in M.Prof.Studies: Applied Economics program.
The course applies microeconomic theory and applied econometric techniques to the study of financial institutions and markets for financial assets. Students will learn how economists model and estimate the value of financial assets. The economic and empirical models are of interest to public policy makers and private wealth managers. Specific topics can include financial intermediation, the regulation of financial institutions, risk management, portfolio theory, the capital asset pricing model and the efficient markets hypothesis.

ECON 671 Economics of Health Care (3 credits)

Prerequisite: ECON641; and must have completed or be concurrently enrolled in ECON645. Credit only granted for: ECON671 or ECON565. Formerly: ECON565.
An examination of the structure, conduct and performance of the health care market, including a study of physician services, the pharmaceutical industry, the hospital market and health insurance. Extensive use of quantitative and analytic economic tools with special emphasis on regulatory response to market imperfections.

ECON 672 Program Analysis and Evaluation (3 credits)

Prerequisite: ECON641 and ECON645.
Students study the tools used to evaluate the effectiveness of public policies. All evaluations have weaknesses, and some have more weaknesses than others. You will learn how to distinguish high from low quality evaluations. We will discuss the basic economics and econometrics of program evaluation, focusing on the application of methods used for causal inference and cost-benefit analyses in public policy contexts. We will examine published evaluation research with the intent of showing how the research does or does not lead to clear conclusions regarding program performance.

ECON 673 Information, Game Theory and Market Design (3 credits)

Prerequisite: ECON641; and must have completed or be concurrently enrolled in ECON644.
A study of the strategic decision-making and the theory and practice of market design. Focus is on the design of organized market and incentives created by market rules. Topics include online auction markets, government auctions procurement auctions and matching markets. The analysis includes documenting the rules of real-world markets, game theoretic analysis, empirical analysis, and experimental work.

ECON 674 Economic Analysis of Law (3 credits)

Prerequisite: ECON641; and must have completed or be concurrently enrolled in ECON644.
A study of the application of economics to law with a focus on game theory, strategic behavior and public policy.

ECON 675 Environmental Economics (3 credits)

Prerequisite: ECON641; and must have completed or be concurrently enrolled in ECON645.
A study of the nature of environmental regulation focusing on U.S. environmental policies and policy debates.

ECON 676 Economic Development (3 credits)

Prerequisite: ECON641; and ECON642; and must have completed or be concurrently enrolled in ECON644. Restriction: Must be in M.Prof.Studies: Applied Economics program.
Analysis of economic development. The course will focus on the consequences of poverty and poor institutions for the behavior and welfare of individuals, households, firms and the aggregate economy in developing countries. Theoretical models and empirical evidence will be used to understand the intended and unintended consequences of policies designed to enhance economic development.

ECON 681 Comparative Institutional Economics I (3 credits)

Theory, empirics, and practice of economic institutions. Genesis, functions, and effects of institutions. Examinations of three major institutions, property, contract, and decentralization. Historical, cultural, political, and economic origins of institutions. Case studies from English history, comparative legal studies, China, history of world economic development, transition, and socialism. Perspectives from law and economics, contract theory, and information theory.

ECON 682 Comparative Institutional Economics II (3 credits)

Prerequisite: ECON681.
A continuation of ECON 681. A topics course focusing on current developments in the literature, such as legal origins, empirical studies of the effects of institutions on trade, development, finance, contract, and property, culture as institution and institutional determinant, theory and practice of measurement of institutions, the design of institutions,legal transplants.

ECON 683 International Macroeconomics and Finance (3 credits)

Prerequisite: ECON641 and ECON642; and must have completed or be concurrently enrolled in ECON644. Restriction: Must be in M.Prof.Studies: Applied Economics program.
Economic analysis of international macroeconomic issues and policy. Topics can include the study of exchange rates, balance of payments, international financial markets, international business cycles, contagion, and the roles played by international economic institutions.

ECON 684 Applied Time Series Analysis and Forecasting (3 credits)

Prerequisite: ECON642; and ECON645. Restriction: Must be in M.Prof.Studies: Applied Economics program.
This course builds on the brief introduction to time series econometrics offered in ECON 645. Students will learn the theory of stationary processes and how it applies to econometric techniques for estimation and forecasting based on time series data. The techniques will be applied in macroeconomic, financial and business applications.

ECON 698 Selected Topics in Economics (3 credits)

ECON 701 Advanced Macroeconomics I (3 credits)

Prerequisite: ECON602 and ECON601.
Recent developments in macroeconomics with an emphasis on topics and techniques useful for conducting research in macroeconomics. Topics include advanced treatment of fiscal and monetary policy issues; the role of imperfect competition; real, sectoral and nominal business cycle models.

ECON 702 Advanced Macroeconomics II (3 credits)

Prerequisite: ECON602 and ECON601.
Selected issues in monetary economics with an equal emphasis of learning the models and understanding important issues: a survey of models (cash-in-advance, money-in-the-utility-function, transaction cost, search-based models), empirical issues in monetary economics, business cycles and money, monetary policy, welfare cost of inflation, alternative media of exchange.

ECON 703 Advanced Microeconomics I (3 credits)

Prerequisite: ECON604 and ECON603.
Formal treatment of game theory and its microeconomic applications are presented, emphasizing dynamics and information. Equilibrium concepts for static and dynamic games, and games with complete and incomplete information are studied. Topics also discussed: mechanism design, efficiency, reputations, signaling, and screening.

ECON 704 Advanced Microeconomics II (3 credits)

Prerequisite: ECON604 and ECON603.
This is the second half of a two-semester sequence in Advanced Microeconomics, intended for second-year Ph.D. students. The course material varies from year-to-year, but currently it focuses on auction theory, matching theory, and the relationship between matching and auction theory. Other topics that are treated in some years include: sequential bargaining under incomplete information; and equilibrium refinements.

ECON 708 Advanced Topics in Applied and Theoretical Microeconomics (2 credits)
Prerequisite: Must have completed a one-year graduate sequence in one of the microeconomic fields. Repeatable to 12 credits if content differs.
Read, discuss, and analyze current topics in microeconomics, including public economics, environmental economics, labor economics, industrial economics, microeconomic theory, public choice and international trade. Specific topics covered will change from semester to semester depending on the students' and faculty's interests. Intended primarily for students beginning thesis research in economics.

ECON 709 Advanced Topics in Applied and Theoretical Macroeconomics (2 credits)
Prerequisite: Must have completed a one-year graduate sequence in one of the macroeconomic fields. Repeatable to 12 credits if content differs.
Read, discuss, and analyze current topics in macroeconomics, including asset pricing models, models of economic growth, investment, and the labor market. Specific topics covered will change from semester to semester depending on the students' and faculty's interests. Intended primarily for students beginning thesis research in economics.

ECON 721 Econometrics III (3 credits)
Prerequisite: ECON624; or permission of BSOS-Economics department.
Oriented towards macro-econometric methods. Topics covered will be selected from the following: Further discussion of topics covered in ECON624, nonlinear time series models, exogeneity and causality, non-stationary time series models (unit roots, co-integration, error correction models, vector autoregressive models), econometric models of volatility (ARCH and GARCH models, and Stochastic volatility models), rational expectations models, non-stationary panel data models, tests for structural change, Bayesian econometrics and methods for Bayesian computation.

ECON 722 Econometrics IV (3 credits)
Prerequisite: ECON624; or permission of BSOS-Economics department.
Oriented towards micro-econometric methods. Topics covered will be selected from the following: Further discussion of topics covered in ECON624, binary and multinomial response models, censored and truncated regression models, sample selection models, count data models, duration models program evaluation and treatment effects methods, structural econometrics, the identification problem, stratified and clustered samples, spatial/cross sectional dependence models, dynamic panel data models, weak instruments, non-parametric estimation, boot strap and Jack Knife methods, pre-test estimators.

ECON 723 Time Series Econometrics (3 credits)
Prerequisite: ECON722 or ECON622; or permission of instructor.
Provides a broad survey of the models and methods commonly used in the analysis of time series data. Emphasis on analyzing the statistical properties of the methods being discussed. Particular attention to recent developments in time series econometrics.

ECON 741 Advanced International Economics I (3 credits)
Prerequisite: ECON601; or permission of BSOS-Economics department.
Exchange rate determination; exchange rate regimes; international monetary reform; policy conflict and cooperation; the LDC debt problem; pricing of international assets; balance of payments crises.

ECON 742 Advanced International Economics II (3 credits)
Prerequisite: ECON603; or permission of BSOS-Economics department.
Comparative advantage, Heckscher-Ohlin theory, specific-factors model, empirical verification, economies of scale, imperfect competition, commercial policy, factor mobility.

ECON 743 Topics in International Finance (3 credits)
Prerequisite: ECON602; or permission of BSOS-Economics department. Recommended: ECON741.
Puzzles in international finance; portfolio balance, current account dynamics, exchange rate behavior; capital market imperfections; balance of payments crises.

ECON 744 Business Cycle Theory of Emerging Economies (3 credits)
Prerequisite: ECON602 and ECON604. Credit only granted for: ECON698M or ECON744. Formerly: ECON698M.
An advanced course in International Economics that studies business cycle theory for emerging economies. It develops a set of quantitative tools for studying the determinants of international capital flows and their business cycle implications, with emphasis on the "Sudden Stop" phenomenon of emerging-markets crises. The course blends elements of real business cycle theory, international finance and equilibrium asset pricing theory and it relies heavily on recursive macroeconomic theory. Familiarity with computing software and the techniques covered in a course on computational economics are also useful, but not required in advance.

ECON 745 Advanced Topics in International Trade (3 credits)
Prerequisite: ECON604 and ECON624. Credit only granted for: ECON698L or ECON745. Formerly: ECON698L.
Designed primarily for students planning to write dissertations on a topic related to international trade. Its focus is on recent research in this field including tests of trade theories; the effects of trade on growth and knowledge diffusion; the political economy of trade policy and the theory and practice of trade agreements.

ECON 746 Topics in International Trade (3 credits)
Restriction: Permission of BSOS-Economics department.
Topics include the impact of trade on labor markets; the role of international trade for economic development; the use of general equilibrium models for quantifying the gains from trade and the welfare and distributive effects of various trade shocks; the impact of trade on productivity; and dynamic models of trade.

ECON 747 The Macreconomics of Imperfect Capital Markets (3 credits)
Prerequisite: ECON602 and ECON601; or (ECON604 and ECON603); or permission of BSOS-Economics department. Restriction: Must be in one of the following programs (Economics (Master's); Economics (Doctoral)). Credit only granted for: ECON698K or ECON747. Formerly: ECON698K.
After a brief overview of the micro-foundations of capital market imperfections, topics include limited commitment, the financial accelerator, liquidity, bubles, crises, the role of credit in monetary economics as well as international capital flows.

ECON 752 Public Economics II (3 credits)
Prerequisite: ECON751.
Theoretical and empirical issues in taxation, with particular emphasis on income taxation.

ECON 754 Topics in Political Economy I (3 credits)
Prerequisite: ECON602 and ECON604; or permission of BSOS-Economics department.
Study of political determinants of macroeconomic outcomes. Time inconsistency in monetary and fiscal policy, political business cycles. Political models of redistribution, delay in reform, transition, growth, and international policymaking.

ECON 756 Empirical Political Economics (3 credits)
Prerequisite: ECON623, ECON624, and ECON754; or students who have taken courses with comparable content

may contact the department.
Restriction: Permission of BSOS-Economics department.
An introduction to empirical political economy. Determinants of individual political behavior and the impact of political rules on economic outcomes will both be analyzed. Modern applied econometric techniques will also be covered.

ECON 757 Topics in Political Economy II (3 credits)
Prerequisite: ECON602 and ECON604; or permission of BSOS-Economics department. Recommended: ECON754.
A continuation of ECON754 Topics in Political Economy I. Topics will include: the informational role of special interest groups; campaign finance, including welfare analysis of campaign finance reform; advanced models of the political economy of redistribution, with emphasis on inefficient redistribution, intergenerational redistribution, and "pork barrel" politics; fairness and redistributive politics; the effects of alternative electoral systems; theoretical models of parliamentary democracies, government formation and political parties; accountability of government officials; and the political economy of federalism.

ECON 771 Advanced Labor Economics: Theory and Evidence (3 credits)
Prerequisite: ECON603 and ECON624; or permission of BSOS-Economics department.
Modern analytical and quantitative labor economics. Labor supply decisions of individuals and households; human capital model and distribution of income. Demand for labor; marginal productivity theory, imperfect information and screening. Interaction of labor demand and supply; unemployment; relative and absolute wages; macroeconomic aspects of the labor market.

ECON 772 Population Economics (3 credits)
Prerequisite: ECON771; or permission of BSOS-Economics department.
Covers the central ideas in population economics. These include theory and test of theories of mortality, fertility and immigration.

ECON 773 Econometric Approaches for Research in Applied Microeconomics (3 credits)
Prerequisite: ECON722; and (ECON772 or ECON771).
Duration models, propensity score matching, regression discontinuity, weak instruments, heterogenous treatment effect and other advanced topics used in empirical microeconomics.

ECON 781 Valuing Environmental Benefits (3 credits)
Prerequisite: ECON603; and ECON623. Or students who have taken courses with comparable content may contact the department.
The theory and practice of valuing environmental benefits, including the health, recreation and aesthetic benefits associated with controlling air and water pollution, and the damages associated with climate change. Estimation of the benefits of energy efficiency improvements-including the benefits of fuel economy standards.

ECON 785 Advanced Economics of Natural Resources (3 credits)
Prerequisite: ECON603, ECON604, and ECON624.
The use of exhaustible and renewable natural resources from normative and positive points of view. Analysis of dynamic resource problems emphasizing energy, mineral, groundwater, forestry, and fishery resources; optimal, equilibrium, and intergenerational models of resource allocation.

ECON 799 Master's Thesis Research (1-6 credits)

ECON 808 Workshop on Macroeconomics and Growth (2 credits)
Restriction: Permission of BSOS-Economics department. Repeatable to 12 credits if content differs.

ECON 818 Workshop in Microeconomic Theory (2 credits)
Repeatable to 12 credits if content differs.
Current research in microeconomic theory. Topics drawn from game theory, mathematical economics, and the economics of information and will include applications of the theory to diverse areas of economics. Specific topics: bargaining, auctions, mechanism design, signaling, general equilibrium, industrial organization theory, and financial markets theory.

ECON 825 Advanced Economic Welfare Analysis (3 credits)
Prerequisite: ECON604 and ECON603; or permission of BSOS-Economics department. Credit only granted for: ECON825 or AREC825.
Theory of economic welfare measurement, problems of path dependence in evaluating multiple price changes, welfare measurement under risk, general equilibrium welfare measurement with multiple distortions, and applications in evaluation of agricultural and resource policies.

ECON 828 Workshop in Econometrics (2 credits)
Repeatable to 12 credits if content differs.
Current research in econometrics. Topics drawn from theoretical and applied econometrics. Special topics include: maximum likelihood and generalized method of moments estimation of linear and non-linear models, analysis of stationary and non-stationary time series, cross section time series estimation, spatial estimation mehtods, Bayesian methods, semi-and non-parametic methods, rational expectations models, numerical methods, and various applications.

ECON 848 Workshop in International Development, and Comparative Economics (2 credits)
Restriction: Permission of BSOS-Economics department. Repeatable to 12 credits if content differs.

ECON 858 Workshop in Public Economics (3 credits)
Restriction: Permission of BSOS-Economics department. Repeatable to 6 credits if content differs.

ECON 868 Workshop in Industrial Organization (2 credits)
Restriction: Permission of BSOS-Economics department. Repeatable to 12 credits if content differs.

ECON 878 Workshop in Labor Economics (2 credits)
Restriction: Permission of BSOS-Economics department. Repeatable to 12 credits if content differs.

ECON 888 Workshop in Comparative Institutional Economics (2 credits)
Restriction: Permission of BSOS-Economics department. Repeatable to 12 credits if content differs.
Current research in institutional economics and closely related fields such as economic transition, economic development, economic theory, law and economics, political economics, and economic history. Topics are drawn from both theoretical analysis of institutions and empirical studies of the effects and determinants of institutions.

ECON 898 Pre-Candidacy Research (1-8 credits)

ECON 899 Doctoral Dissertation Research (1-8 credits)

Curriculum and Instruction (EDCI)

EDCI 400 Field Experience in Art Education (1 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Secondary Educ: Art program.
Practical classroom experience in teaching/evaluating/exhibiting the products of art lessons.

EDCI 401 Student Teaching in Elementary School: Art (4-8 credits)
Prerequisite: EDCI405. Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Secondary Educ: Art program.

EDCI 402 Student Teaching in Secondary Schools: Art (2-8 credits)
Prerequisite: EDCI405. Restriction: Minimum cumulative GPA of 2.75; and must be in Secondary Educ: Art program; and permission of Teaching and Learning, Policy and Leadership Department.

EDCI 403 Introduction to Teaching Art in Schools (3 credits)
Restriction: Minimum cumulative GPA of 2.75.
Introduction to the field of Art Education and the role of the visual arts in grades PreK-12 for today's diverse school populations. The fundamental, historical and philosophic components of art education with an emphasis on arts disciplines and curriculum. Includes a school-based practicum. For those considering art education as a major.

EDCI 404 Student Teaching Seminar: Art Education (3 credits)
Prerequisite: EDCI405 and EDCI400. Corequisite: EDCI402 and EDCI401. Restriction: Minimum cumulative GPA of 2.75; and must be in Secondary Educ: Art program.
An analysis of teaching theories, strategies, and techniques in the student teaching experience.

EDCI 405 Art Education Methods I (3 credits)
Restriction: Must be in Secondary Educ: Art program; or must be in Secondary Educ: Art pre-major program. And minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI300 or EDCI405. Formerly: EDCI300.
Methods I provides future art teachers with a knowledge base of the theories and best practices of effective pedagogy for: teaching methods and strategies, diversity, motivational techniques, classroom management, assessment and evaluation methods, and accommodating all students including those with special needs.

EDCI 406 Technology and Two-Dimensional Art (3 credits)
Prerequisite: ARTT210. Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department; and junior standing or higher; and must not be in any of the following programs (Early Childhood Education; Elementary Education; Secondary Educ: Science; Secondary Educ: English Language Arts; Secondary Educ: Mathematics; Secondary Educ: Foreign Languages; Secondary Educ: Social Studies; Physical Education; Music Education; Special Education).
A discussion/studio format used to develop skills, materials, resources and education strategies for using technology and two-dimensional art in K-12 programs.

EDCI 407 Practicum in Art Education: Three-Dimensional (3 credits)
Restriction: Must be in Secondary Educ: Art program; or must be a Pre-Art Education Major.
A lecture-studio course to develop skills, material resources, and educational strategies for three-dimensional projects in school settings.

EDCI 410 Methods I: K-12 World Language Methods and Technology (3 credits)
Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI330 or EDCI410. Formerly: EDCI330.
The first of two sequential courses required for achieving competence i teaching a foreign language. The sequel to this course is EDCI433 (Methods II) entitled: Advanced K-12 Foreign Language Methods and Technology. EDCI410 requires on-going examination of theories relevant to language acquisition. Students will also investigate the instructional methods that reflect those theories. Lab and field experiences required.

EDCI 411 Knowledge, Reasoning, and Learning in Science (3 credits)
Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI370 or EDCI411. Formerly: EDCI370.
For prospective science teachers. Investigations of the nature of knowledge, reasoning, and learning in middle and secondary science. Readings from cognitive science and science education research; studies of student thinking in interview and classroom observations; analyses of curricula. Includes laboratory and field experiences.

EDCI 413 Interdisciplinary Teaching in the Middle Grades I (2 credits)
Prerequisite: EDCI457 and EDCI411; or permission of instructor. Corequisite: EDCI360 and EDCI424. Restriction: Minimum cumulative GPA of 2.75; and must be in the Middle School Teacher Education Program, major code 0804P.
For prospective middle school teachers. Studying and planning interdisciplinary instructional practices in middle school. Utilizes context and experiences from students' field placements. Use of technology and incorporation of technology into instruction.

EDCI 414 Interdisciplinary Teaching in the Middle Grades II (2 credits)
Prerequisite: EDCI360 and EDCI413. Corequisite: EDCI425 and EDCI460. Restriction: Minimum cumulative GPA of 2.5; and must be in the Middle School Teacher Education Program.
For prospective middle school teachers. Planning and implementing interdisciplinary instructional practices in middle school. Draws on the context of and experiences in the student teaching placement. Use of technology and incorporation of technology into instruction.

EDCI 416 Teaching and Learning in Secondary Education: English (3 credits)
Credit only granted for: EDCI340 or EDCI416. Formerly: EDCI340.
An introduction for prospective middle and secondary English teachers into the basic issues, concepts, orientations, and processes that shape the teaching of English for diverse students in schools. Candidates explore their own perspectives in relation to local and national trends and develop basic teaching understanding and skills through on-campus seminars, teaching laboratory experiences, and guided field experiences. Students should reserve one full day or two half days per week for field experience.

EDCI 417 Bases for English Language Instruction (3 credits)
Restriction: Must be in Secondary Educ: English Language Arts program;

and minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department.
Examines current theory, research, best practice, curricula and materials focused on the teaching of English language to native and non-native English learners. Topics include morphology, syntax, semantics, vocabulary, pragmatics, argument, discourse structure, dialects, edited academic English, English language proficiency (listening, speaking, reading, writing) assessment, and instructional planning. English Language Learner (TESOL and SIOP) and special needs (inclusion) pupil issues considered.

EDCI 420 Student Teaching Seminar in Secondary Education: Social Studies (1 credits)
Prerequisite: EDCI426 and EDCI427. Corequisite: EDCI421 and EDCI422. Restriction: Minimum cumulative GPA of 2.75.
An analysis of teaching theories, strategies, and techniques in the student teaching experience.

EDCI 421 Student Teaching in Secondary Schools: Social Studies/History (12 credits)
Prerequisite: Admission to teacher education program. Corequisite: EDCI420. Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Secondary Educ: Social Studies program.

EDCI 422 Student Teaching in Secondary Schools: Social Studies/Geography (12 credits)
Prerequisite: EDCI321. Corequisite: EDCI420.

EDCI 423 Art Education Methods II (3 credits)
Prerequisite: EDCI405; or students who have taken courses with comparable content may contact the department. Corequisite: EDCI400. Restriction: Minimum cumulative GPA of 2.75; and must be in Secondary Educ: Art program.
Methods II builds upon the pedagogical foundation of Methods I and provides future art teachers with the means for developing pre K-12 art lessons and unit plans for a balanced qualitative art program for today's diverse and inclusive schools and classrooms.

EDCI 424 Equitable Classrooms (2 credits)
Prerequisite: EDCI297, EDCI457, and EDCI411. Corequisite: EDCI360 and EDCI413. Restriction: Minimum cumulative GPA of 2.75; and must be in Middle School Education program.
An exploration and application of major theoretical frameworks surrounding equity and critical pedagogy. Creating habits of mind that help teachers see all students as capable of achieving at high levels. Draws on the concurrent field experience.

EDCI 425 Equity and Pedagogy (2 credits)
Prerequisite: EDCI424. Corequisite: EDCI414 and EDCI460. Restriction: Minimum cumulative GPA of 2.75; and must be in one of the following programs (Middle School Education; Early Childhood Education; Elementary Education; Secondary Educ: Science; Secondary Educ: English Language Arts; Secondary Educ: Mathematics; Secondary Educ: Foreign Languages; Secondary Educ: Social Studies; Physical Education; Music Education; Secondary Educ: Art; Special Education).
An exploration and application of major theoretical frameworks surrounding equity and critical pedagogy. Pedagogical decision making that leads to greater equity and improved student learning for all students. Draws on the concurrent student teaching experience.

EDCI 426 Knowledge, Reasoning, and Learning in Secondary Social Studies (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department; and minimum cumulative GPA of 2.75.
An exploration of the nature of knowledge and reasoning in social studies disciplines as well as how students learn social studies. Assessment and investigation of students' conceptions and misconceptions as well as their disciplinary thinking. Implications for teaching and initial lesson design are explored through on-campus seminars as well as guided field experiences. Students should reserve a regular half-day per week for the field experience in local schools. This course is required for admission to the secondary social studies double major.

EDCI 427 Curriculum, Teaching, and Assessment in Secondary Social Studies (3 credits)
Prerequisite: EDCI426. Corequisite: EDCI428. Restriction: Must be in Secondary Educ: Social Studies program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Center for Learning & Educational Technology.
An exploration of curriculum development, teaching, and assessment in secondary history/social studies. Focus on identifying students' conceptions of social studies topics and designing lessons that advance students' disciplinary thinking and understanding.

EDCI 428 Field Experience in Secondary Social Studies Teaching (1 credits)
Corequisite: EDCI427. Restriction: Must be in Secondary Educ: Social Studies program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Practical experience as an aide to a regular social studies teacher; assigned responsibilities and participation in a variety of teaching/learning activities. Students must reserve one full day per week for internship placement.

EDCI 430 Student Teaching Seminar in Secondary Education: World Language (1 credits)
Prerequisite: EDCI410 and EDCI433. Corequisite: EDCI431 and EDCI474. Restriction: Must be in Secondary Educ: Foreign Languages program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
An analysis of teaching theory, strategies and techniques in the internship experience.

EDCI 431 Teaching Internship in Secondary Schools: World Language (12 credits)
Prerequisite: EDCI410 and EDCI433. Corequisite: EDCI430 and EDCI474. Restriction: Minimum cumulative GPA of 2.75; and must be in Secondary Educ: Foreign Languages program. Or permission of EDUC-Teaching, Learning, Policy and Leadership department. Additional information: Internship lab fee applies. See current program description for details.
Practical experience as a full-time intern with a fully licensed World Language teacher in a diverse school setting; assigned professional responsibilities and participates in teaching/learning experiences.

EDCI 432 Issues in the Education of English Language Learners (3 credits)
Credit only granted for: EDCI432 or EDCI488Q. Formerly: EDCI488Q.
Introduction to and analysis of current and historical research, practice, trends, and public policy issues in education as they relate to English language learners in K-12 and other settings.

EDCI 433 Advanced K-12 World Language Methods and Technology (3 credits)
Prerequisite: EDCI410. Corequisite: EDCI438. Restriction: Must be in Secondary Educ: Foreign Languages program; and minimum cumulative GPA of 2.75. Or permission of EDUC-

Teaching, Learning, Policy and Leadership department.
Teaches advanced best practices for effective foreign language instruction. Topics include: using authentic assessment and materials, applying national standards, teaching writing and culture, motivating students, providing strategy instruction, infusing technology, preparing for K-12 employment, and creating a professional portfolio.

EDCI 434 Pedagogy of Teaching English Language Learners (3 credits)
A survey of the historical and current approaches, methods, and techniques of teaching English to speakers of other languages, from grammar translation and audiolingual to communicative and task-based approaches will be presented. Additionally, successful classroom practices that address the needs of culturally diverse and language minority students will be analyzed. Students will have the opportunity to discuss, probe and apply theories and principles to hands-on teaching practices in real-life settings. Digital technologies that assist teaching English language learners (ELLs) will be emphasized as well.

EDCI 435 Teaching English Language Learners Reading and Writing in the Secondary Content Areas (3 credits)
Analysis of approaches to curriculum, current research, theory, and pedagogy of reading and writing to second language students from diverse cultural and linguistic backgrounds. State Approved. Required for TESOL certification program.

EDCI 436 Understanding Cross-Cultural Communication for Teaching English Language Learners (3 credits)
Credit only granted for: EDCI436 or EDCI488T. Formerly: EDCI488T.
Theories of intercultural communication and techniques for applying them in the teaching of English as a second language (ESL) and content classes. Research and evaluation of selected aspects of a culture as basis for creating, selecting and using culturally-responsive teaching materials and methods.

EDCI 437 English Grammar Pedagogy for Teachers of English Language Learners (3 credits)
Credit only granted for: EDCI437 or EDCI488P. Formerly: EDCI488P.
Methods of teaching English grammar to English language learners. The role of teaching grammar. Effective methods and techniques for incorporating grammar in other communication activities.

EDCI 438 Field Experience in Second Language Education (1 credits)
Corequisite: EDCI330. Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Secondary Educ: Foreign Languages program. Repeatable to 3 credits if content differs.
Practical experience as an aide to a regular foreign language teacher; assigned responsibilities and participation in a variety of teaching/learning activities.

EDCI 440 Internship Seminar in Secondary Education: English (1 credits)
Prerequisite: EDCI447 and EDCI467. Corequisite: EDCI441 and EDCI474. Restriction: Must be in Secondary Educ: English Language Arts program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
A review and analysis of current instructional theories, strategies and best practice in relation to the teaching internship. Meets at area high school; location provided before first meeting.

EDCI 441 Internship in Secondary Schools: English (12 credits)
Prerequisite: EDCI447 and EDCI467. Corequisite: EDCI440 and EDCI474. Restriction: Must be in Secondary Educ: English Language Arts program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Practical experience as a full-time intern with a fully licensed English teacher in a diverse school setting; assigned professional responsibilities and participates in teaching/learning experiences. Internship lab fee applies. See current program description for details.

EDCI 443 Literature for Children and Youth (3 credits)
Restriction: Must be in Elementary Education program; or must be a Pre-Education Major.
Analysis of literary materials for children and youth. Timeless and ageless books, and outstanding examples of contemporary publishing. Evaluation of the contributions of individual authors, illustrators and children's book awards.

EDCI 447 Field Experience in English Teaching (1 credits)
Corequisite: EDCI467. Restriction: Must be in Secondary Educ: English Language Arts program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Practical experience as a part-time intern working with a fully licensed English teacher in a diverse school setting. Students must reserve one full day or two half days per week for the part-time internship.

EDCI 448 Student Teaching in Secondary Schools: Theatre/English (12 credits)
Prerequisite: EDCI417. Corequisite: EDCI440. Restriction: Must be in Secondary Educ: English Language Arts program.
Practical experience as an aide to a regular English, speech or drama teacher; assigned responsibilities and participation in a variety of teaching/learning activities.

EDCI 450 Internship Seminar in Secondary Education: Mathematics (1 credits)
Prerequisite: EDCI457 and EDCI455. Corequisite: EDCI451 and EDCI474. Restriction: Must be in Secondary Educ: Mathematics program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Strategies and techniques in the internship experience. Structured work on teaching portfolio (requirement for graduation and certification). Place, day, and time to be arranged.

EDCI 451 Student Teaching in Secondary Schools: Mathematics (12 credits)
Corequisite: EDCI450. Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Secondary Educ: Mathematics program.

EDCI 455 Teaching and Learning High School Mathematics (3 credits)
Prerequisite: Must have 2 semesters of calculus; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Corequisite: EDCI355. Restriction: Must be in Secondary Educ: Mathematics program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Methods of teaching and assessing the high school mathematics curriculum; aligning tasks and activities to curriculum standards; lesson planning; and selection and use of technology. The course also focuses on managing large group dynamics in the high school mathematics classroom.

EDCI 457 Teaching and Learning Middle School Mathematics (3 credits)
Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-

Teaching, Learning, Policy and Leadership department.
Methods of teaching and assessing the middle school mathematics curriculum. Understanding the conceptual difficulties students have in moving from whole numbers to rational numbers, additive thinking to multiplicative thinking, and arithmetic to algebra. Lesson planning and selection of technology and other materials are applied in the context of supervised tutoring of students having difficulty in middle school mathematics. Lab and field experience required. Supervised tutoring takes place on site at a local middle school therefore EDCI 457 students will be expected to travel to a local middle school for 8-10 of the class meetings.

EDCI 460 Student Teaching: Middle School (12 credits)
Prerequisite: EDCI413. Corequisite: EDCI414 and EDCI425. Restriction: Minimum cumulative GPA of 2.5; and permission of EDUC-Teaching, Learning, Policy and Leadership department; and for Middle School Education majors only.
A Middle-school student teaching experience in two content areas.

EDCI 461 Materials and Instruction for Creating Skilled and Motivated Readers, Part I (3 credits)
Restriction: Must be in Elementary Education program; and junior standing or higher. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Selecting, evaluating, and using a variety of materials and instructional strategies to create skilled and motivated readers in the elementary grades; Topics include emergent literacy, vocabulary development, reading comprehension and oral reading fluency in diverse classroom settings.

EDCI 462 Materials and Instruction for Creating Skilled and Motivated Readers, Part II (3 credits)
Prerequisite: EDCI397 and EDCI461. Corequisite: EDCI352, EDCI342, EDCI372, and EDCI322. Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Elementary Education program.
Selecting, evaluating, and using a variety of materials to create skilled and motivated readers in the elementary grades, particularly in diverse classroom settings; Topics include word analysis, spelling, writing, reading comprehension strategies, directed reading lessons, and explicit instruction.

EDCI 463 Reading in the Secondary School (3 credits)
Restriction: Minimum cumulative GPA of 2.75; and must be in one of the following programs (Middle School Education; Secondary Educ: Science; Secondary Educ: English Language Arts; Secondary Educ: Mathematics; Secondary Educ: Foreign Languages; Secondary Educ: Social Studies; Secondary Educ: Art) ; and permission of department required for post-baccalaureate students.
Provides secondary school teachers with understanding the need for and approaches to teaching students to read and learn from content area texts.

EDCI 464 Assessment for Reading (3 credits)
Prerequisite: EDCI362. Restriction: Senior standing. And must be in Elementary Education program; or must be in Early Childhood Education program.
Examination of reading assessment theory, materials and procedures; Topics include validity and reliability in reading assessment, formal and informal assessment, reading instruction that is informed by ongoing assessment, and the effects of assessment on students and schooling in a diverse society.

EDCI 465 Teaching Reading in Middle School Content Areas (3 credits)
Restriction: Minimum cumulative GPA of 2.5; or permission of EDUC-Teaching, Learning, Policy and Leadership department; or must be in the Middle School Teacher Education Program. Credit only granted for: EDCI463 or EDCI465.
Provides middle school teachers with understanding the need for and approaches to teaching students to read and learn from information texts in various content areas.

EDCI 466 Literature for Adolescents (3 credits)
Restriction: Minimum cumulative GPA of 2.75; and permission of EDUC-Teaching, Learning, Policy and Leadership department.
Reading and analysis of fiction and nonfiction; methods for critically assessing quality and appeal; current theory and methods of instruction; research on response to literature; curriculum design and selection of books.

EDCI 467 Teaching Writing (3 credits)
Corequisite: EDCI447. Restriction: Must be in Secondary Educ: English Language Arts program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Examines current theory, research, best practice, curricula and materials for teaching written communication in grades K-12. Focuses on analytical, argumentative, informative/explanatory, literary analysis, narrative, descriptive, and research writing. Emphasizes instructional planning, assessment, writer problem-solving strategies, information search, development, organization and style appropriate to task, purpose and audience for both non-digital and digital text. English Language Learner and special needs pupil issues considered.

EDCI 470 Learning and Teaching in Science (3 credits)
Prerequisite: EDCI411; or permission of instructor. Restriction: Must be in Secondary Educ: Science program.
Studies of student learning and instructional practices in science teaching.

EDCI 471 Internship in Secondary Schools: Science (12 credits)
Prerequisite: EDCI470. Corequisite: EDCI480 and EDCI474. Restriction: Must be in Secondary Educ: Science program; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Practical experience as a full-time intern with a fully licensed science teacher in a diverse school setting; assigned professional responsibilities and participates in teaching/learning experiences. Internship lab fee applies. See current program description for details.

EDCI 474 Teaching Academically, Culturally, and Linguistically Diverse Students in Secondary Education (2 credits)
Corequisite: Enrolled in internship/certification area. Restriction: Must be in one of the following programs (Secondary Educ: Science; Secondary Educ: English Language Arts; Secondary Educ: Mathematics; Secondary Educ: Foreign Languages; Secondary Educ: Social Studies; Secondary Educ: Art) ; and minimum cumulative GPA of 2.75. Or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Multi-disciplinary capstone course for Secondary Education majors. Discussion of pedagogical and content issues relevant for teaching academically, culturally, and linguistically diverse students with particular emphasis on students with special educational needs and English language learners. Students develop and use curriculum-based assessments and/or lessons with these groups of students.

EDCI 475 Embracing Diversity in the Classroom Community (3

credits)
Restriction: Admission to teacher education program; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI475 or EDCI488L. Formerly: EDCI488L.
An exploration of the richness and complexity of student diversity that teacher candidates will encounter in K-12 classrooms. Students will engage in critical reflection around diversity and equity issues.

EDCI 480 Practices in Secondary School Science Teaching (2 credits)
Prerequisite: EDCI470. Corequisite: EDCI471 and EDCI474. Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Secondary Educ: Science program. Or minimum cumulative GPA of 2.75. Credit only granted for: EDCI480 or EDCI488J. Formerly: EDCI488J.
Analyses of student thinking, instructional interpretations, strategies, and techniques in the teaching internship.

EDCI 481 Student Teaching: Elementary (12 credits)
Prerequisite: EDCI352, EDCI362, EDCI342, EDCI372, and EDCI322. Corequisite: EDCI464. Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department; and must be in Elementary Education program; and minimum cumulative GPA of 2.75.

EDCI 485 Student Teaching in Elementary School: Physical Education (4-8 credits)
Restriction: Must be in Physical Education program.
Fulfills elementary teaching requirements in K-12 physical education programs.

EDCI 488 Selected Topics in Teacher Education (1-3 credits)
Restriction: Must be in a major within EDUC-Teaching, Learning, Policy and Leadership department; or must be in Curriculum and Instruction (Doctoral) program; or must be in Curriculum and Instruction (Master's) program; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 6 credits if content differs.

EDCI 489 Field Experiences in Education (1-4 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 4 credits.

EDCI 495 Student Teaching in Secondary Schools: Physical Education (2-8 credits)
Restriction: Must be in a major within EDUC-Teaching, Learning, Policy and Leadership department; or must be in Curriculum and Instruction (Doctoral) program; or must be in Curriculum and Instruction (Master's) program.

EDCI 497 The Study of Teaching (3 credits)
Prerequisite: EDCI481. Corequisite: EDCI489.
Identification and examination of learner and teacher outcome variables related to teaching systems, methods, and processes. Methods of conducting classroom research.

EDCI 498 Special Problems in Teacher Education (1-6 credits)
Restriction: Must be in a major within EDUC-Teaching, Learning, Policy and Leadership department; or must be in Curriculum and Instruction (Doctoral) program; or must be in Curriculum and Instruction (Master's) program; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 6 credits.
Individual study of approved problems.

EDCI 499 Workshops, Clinics, and Institutes (1-6 credits)
Repeatable to 6 credits.
The following types of educational enterprise may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDCI 588 Special Topics in Curriculum & Instruction (1-3 credits)
Repeatable to 6 credits if content differs.
Current topics and issues in teaching. Workshops and seminars that address professional topics and issues in curriculum, teaching, and learning in schools.

EDCI 600 Trends in Art Education Curriculum (3 credits)
Recent developments in art education.

EDCI 601 Shifting Paradigms in Arts Education: Historical Investigations (3 credits)
An investigation into major historical events and underlying beliefs, values and practices that influence contemporary arts education (visual art, drama, dance, music) at all levels of instruction. Selected literature that focuses on cultural contexts, individuals, institutions, events and national and international perspectives is used to investigate changing conceptions and practices of arts education.

EDCI 602 The Teaching of Aesthetics in the Public Schools (3 credits)
Critical investigation of art, and curriculum implications.

EDCI 603 Integrated Art Methods (3 credits)
Prerequisite: EDCI680; or EDCI405. Restriction: Must be in a major within EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI423, EDCI603, or EDCI688D. Formerly: EDCI688D.
Builds upon the pedagogical foundation of an initial art education methods course and provides future art teachers with the means for developing PreK-12 art lesson/unit plans for a balanced qualitative art program for today's diverse and inclusive schools/classrooms. Integratin g art with other subject areas.

EDCI 604 Learning and Teaching in the Physical Sciences I (3 credits)
Restriction: Enrollment in an EDCI Outreach Program in science education; or must be in Curriculum and Instruction (Master's) program; or permission of instructor. Credit only granted for: EDCI604 or EDCI688F. Formerly: EDCI688F.
Engagement in laboratory and inquiry-based methods to develop coherent understandings about the physical world and explore issues in the physical sciences. Personal engagements with phenomena and reflection on the learning and instructional experiences.

EDCI 605 Learning and Teaching in the Physical Sciences II (3 credits)
Prerequisite: EDCI604; or permission of instructor.
A second course in a sequence using laboratory and inquiry-based methods to study physical science learning and teaching. Candidates will move toward more sophisticated understandings of elementary/middle school curriculum topics in the physical sciences. Personal engagement with phenomena and reflection on the learning and instructional experiences.

EDCI 606 Learning and Teaching Biological Sciences (3 credits)

Restriction: Enrollment in an EDCI Outreach Program in science education; or must be in Curriculum and Instruction (Master's) program; or permission of instructor.
Engagement in laboratory and inquiry-based methods to develop coherent understandings about the natural world and explore issues learning in biology. Personal engagement with phenomena and reflection on the learning and instructional experiences.

EDCI 607 Learning and Teaching in the Biological Sciences II (3 credits)
Prerequisite: EDCI606; or permission of instructor.
A second course in a sequence using laboratory and inquiry-based methods to study learning and teaching in biology. Candidates will move toward more sophisticated understandings of elementary/middle school curriculum topics in the life sciences. Personal engagement with phenomena and reflection on the learning and instructional experiences.

EDCI 611 Studying Student Learning in Diverse Settings (3 credits)
This course deepens teacher understanding of student development and the cultural context for teaching through readings and focused field studies. Participants will also begin developing skills needed for investigations using methods of interpretive inquiry.

EDCI 612 Assessing Student Learning and Development (3 credits)
Credit only granted for: EDCI612 or EDCI788S. Formerly: EDCI788S.
Prepares experienced teachers to assess student knowledge, strategies and skills over time so that they can design instruction that builds on student strengths and addresses student needs. Teachers will study the purposes of assessment including school and student needs. Teachers will study the purposes of assessment including school and teacher accountability, student placement, course grade assignment and instructional design. They also will explore types of formal and informal assessment, curriculum-based and curriculum-free assessment, external and teacher made assessment.

EDCI 613 Practice and Theory in Teaching Second Language Learners (3 credits)
Corequisite: EDCI637 or EDCI689; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI613 or EDCI688B. Formerly: EDCI688B.
Focuses on issues that arise while teaching second language (ESOL or foreign language) learners. Supports implementation of theory into practice and research-based best practices during teaching internship, and completion of teaching portfolio during a second field experience.

EDCI 614 Developing a Professional Portfolio (3 credits)
Students will examine issues of performance assessment and develop professional portfolios following the guidelines established by the National Board of Professional Teaching Standards. Drawing on the research data collected throughout their program and relying on inquiry, reflections, and analysis, they will synthesize and present the body of their teaching experience.

EDCI 618 Proseminar for Teaching Internship (1-3 credits)
Prerequisite: Admission to a masters certification program in EDCI. Corequisite: Participation in an arranged school placement. Formerly: EDCI688E.
Supports and complements candidates' internship experiences. Extends skills in implementing less plans (lesson planning), culturally competent teaching, classroom management, issues of professionalism, and protfolio development.

EDCI 619 Developing a Professional Portfolio (1-3 credits)
Repeatable to 3 credits. Credit only granted for: EDCI614 or EDCI619.
Students will examine issues of performance assessment and develop professional portfolios following the guidelines established by the National Board for Professional Teaching Standards. Drawing on the research data collected throughout their program and relying on inquiry, reflections, and analysis, they will synthesize and present the body of their teaching experience.

EDCI 620 Trends in Secondary School Curriculum: Social Studies (3 credits)
Recent developments in educational thinking and practice on the curriculum in social studies.

EDCI 622 Teaching Social Studies in Elementary Schools (3 credits)
Examination of current literature and research in the social sciences as they relate to social studies curriculum and instruction.

EDCI 625 Reading, Cognition, and Instruction: Reading in the Content Areas I (3 credits)
Provides middle and secondary education students with an understanding of the interactive nature of the reading process, the use of research-based instructional strategies, the relationship between vocabulary development and student concept development, the design of strategic reading instruction, the methods for assessing content area literacy, and the ability to plan instruction and communicate with students, parents, and allied professionals.

EDCI 626 Processes and Acquisition of Reading (3 credits)
Restriction: For Master's Certification Students only; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI 626 or EDCI 765. Formerly: EDCI 765.
Addresses the ways in which social, cultural, cognitive and motivation factors influence the development of literacy. Focus is on reading acquisition and its underlying processes. Topics include language development in relation to reading development; the biological basis of this development; concepts in emergent literacy; models of reading acquisition and skilled reading; the effects of phonemic awareness and phonics on developing readers; factors in early childhood environments and in beginning literacy instruction that impact language and literacy achievement.

EDCI 627 Secondary Social Studies Pedagogy (3 credits)
Prerequisite: EDCI426; or EDCI680. Credit only granted for: EDCI627 or EDCI788Y. Formerly: EDCI788Y.
The second course in a three-course teaching methods sequence. Addresses two key questions: (1) How do secondary school students think about and learn history/social studies? (2) How can secondary teachers teach history/social studies in ways that promote student learning?

EDCI 630 Foundations of Second Language Education: Legal, Social and Historical Trends and Issues (3 credits)
Knowledge of history, research, current practice and public policy issues in the field of second languague education from kindergarten to post-secondary settings. Required for TESOL certification program.

EDCI 631 Student Assessment in the Second Language Classroom (3 credits)
Analysis of standardized and teacher-made FL/ESL tests; emphasis on principles of FL/ESL test construction. Field testing of commercial and teacher-made materials.

EDCI 632 Special Education and Oral Language Development in

TESOL (3 credits)
Credit only granted for: EDCI632 or EDCI788L. Formerly: EDCI788L.
Understanding of pre-referal, referal, assessment and identification process, as well as instruction of English Language Learners with learning disabilities. Required for TESOL Certification program.

EDCI 633 Teaching for Cross Cultural Communication (3 credits)
Theories of intercultural communication and techniques for applying them in the teaching of English as a second language (ESL) and content classes. Research and evaluation of selected aspects of a culture as basis for creating, selecting and using culturally-responsive teaching materials and methods.

EDCI 634 Methods of Teaching ESOL (3 credits)
This course presents a survey of the historical and current approaches, methods, and techniques of teaching English to speakers of other languages, from grammar to translation to audiolingual and communicative approaches. Additionally, successful classroom practices that address the needs of culturally diverse and language minority students will be analyzed.

EDCI 635 English Grammar for Teachers of English to Speakers of Other Languages (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
English grammar and methods of teaching grammar for graduate, prospective and current teachers of English to speakers of other languages. Analysis of the major grammatical structures of American English. Discussion of the role of teaching grammar, and effective classroom methods and techniques for the English as a second/foreign language classroom.

EDCI 636 Teaching ESOL Reading and Writing in the Elementary Classroom Areas (3 credits)
Prerequisite: EDCI634.
Analysis of elementary school classroom culture, social contexts, and instructional strategies which foster language development in elementary school content areas.

EDCI 637 Internship in World Language/TESOL Education (2-6 credits)
Prerequisite: EDCI434 and EDCI634; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Additional information: Internship lab fee applies. See current program description for details.
Practical experience as a full-time intern with a fully licensed World Language/TESOL teacher in a diverse school setting; assigned professional responsibilities and participates in teaching/learning experiences.

EDCI 638 Teaching ESOL Reading and Writing in Secondary Content Areas (3 credits)
Prerequisite: EDCI634.
Analysis of approaches to curriculum, current research, theory and pedagogy of reading and writing to second language students from diverse cultural and linguistic backgrounds. Required for TESOL certification.

EDCI 640 Trends in Secondary School Curriculum: English (3 credits)
Recent developments in educational thinking and practice on the curriculum in English education.

EDCI 642 Communications and the School Curriculum (3 credits)
Curriculum development based on communication as the major vehicle for describing the learner's interactions with persons, knowledge, and materials in the classroom and school environment.

EDCI 643 Teaching Language Arts in Elementary Schools (3 credits)
Analysis of current issues, trends, and problems in language-arts instruction.

EDCI 645 Teaching and Learning Geometry in the Middle Grades (3 credits)
Prerequisite: Admission to M.A. or M.Ed. with concentration in Mathematics Education; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI645 or EDCI688C. Formerly: EDCI688C.
Designed to enhance both the pedagogical and geometric content knowledge of middle school mathematics teachers.

EDCI 646 Coaching and Mentoring Teachers: Literacy Across Content Areas (3 credits)
Prerequisite: Enrolled in EDCI post-baccalaureate certificate Program in Literacy coaching. Restriction: Must be in Curriculum and Instruction (Master's) program; and permission of instructor. Credit only granted for: EDCI646 or EDCI788M. Formerly: EDCI788M.
Provides knowledge on coaching and mentoring teachers in school district and school settings based on Standards for Middle and High School Literacy Coaches as well as current theory, research and best practice supporting the efficacy of literacy coaching. Emphasis on understanding reading process/strategy instruction; writing process/ strategy instruction; and gathering and interpreting valid and reliable assessment data for creating district-wide and school-based literacy intervention plans.

EDCI 650 Trends in Mathematics Education (3 credits)
Recent developments in educational thinking and practice which have affected the curriculum in mathematics.

EDCI 651 Teaching and Learning Mathematics in Secondary Schools (3 credits)
Prerequisite: Enrollment in a University of Maryland program leading to teacher certification; and bachelor's degree in mathematics or related field; and 2 semesters of calculus.
Objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks, technology and other instructional materials; assessment of student learning and other topics pertinent to secondary mathematics education. Internship of other placement in a secondary mathematics classroom is required.

EDCI 652 Teaching and Learning Mathematics in the Elementary School (3 credits)
Prerequisite: MATH212, MATH213, or MATH214; or students who have taken courses with comparable content may contact the department.
Strategies and methodologies for the teaching of elementary school mathematics based on current research and theories about how children learn mathematics. Attention is given to professional recommendations and teaching practices that foster communication, reasoning, and reflection in the mathematics classroom. Internship or other placement in an elementary school is required.

EDCI 653 Problem-Solving and Innovative Thinking in the Mathematics Classroom (3 credits)
Prerequisite: Experience teaching mathematics K-12. And EDCI352; or EDCI457; or students who have taken courses with comparable content may contact the department.
Curriculum and instruction for developing thinking skills through the discipline of mathematics. This is a hybrid course designed to blend on-campus class meetings with online experiences.

EDCI 654 Assessing Mathematical Understanding (3 credits)

Prerequisite: EDCI650; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Techniques of assessing k-12 students' understanding of mathematics - including standardized tests, but focusing on alternative forms such as individual interviews, writing tasks, performance tasks, portfolios. Mathematics assessment viewed as an ongoing part of instruction.

EDCI 655 Teaching and Learning Algebra in the Middle School (3 credits)
Prerequisite: Admission to M.A. or M.Ed. with concentration in Mathematics Education; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Designed to enhance middle school mathematics teachers' content and pedagogical knowledge in algebra.

EDCI 656 Teaching and Learning Statistics in the Middle School (3 credits)
Prerequisite: Admission to M.Ed. or M.A. program in EDCI with concentration in Mathematical Education.
Designed to enhance both the pedagogical and statistical/data analysis content knowledge of middle school mathematics teachers.

EDCI 657 Understanding and Engaging Students' Conceptions of Mathematics (3 credits)
Prerequisite: Experience in teaching math; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Research related to K-14 students' common errors in and (mis)understandings of mathematics. Instructional strategies useful in building on errors and changing students' conceptions.

EDCI 660 Foundations of Reading (3 credits)
Prerequisite: EDCI362; or EDCI463; or students who have taken courses with comparable content may contact the department.
Broad and comprehensive overview of reading and literacy and factors that may influence effective reading practices such as instruction, classroom environment and individual differences. Focus on different knowledge domains and traditions of inquiry related to reading and reading instruction.

EDCI 661 Content Area Reading (3 credits)
Prerequisite: EDCI362; or EDCI463; or students who have taken courses with comparable content may contact the department.
Research-based strategies for improving reading to learn in the content areas (K-12).

EDCI 662 Diagnostic Reading Assessment and Instruction (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Survey course in diagnostic reading assessment and instruction for graduate students not majoring in reading.

EDCI 663 Understanding, Evaluating and Using Research in School Reading Programs (3 credits)
Focus on understanding, critiquing, and applying reading/literacy research; reviewing research to improve practice; analyzing data at the district, school, classroom, and student levels to improve reading instruction.

EDCI 664 Clinical Assessment in Reading (3 credits)
Prerequisite: EDCI661 and EDCI663; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Clinical diagnostic techniques and materials for assessing reading strengths and needs.

EDCI 665 Clinical Instruction in Reading (3 credits)
Prerequisite: EDCI664; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Clinical procedures and materials for reading instruction.

EDCI 666 Leadership in Schoolwide Reading Program (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Preparation of reading personnel to function as resource persons to classroom teachers, administrators and the school community.

EDCI 667 Multicultural Materials and Instruction for K-12 Readers (3 credits)
Credit only granted for: EDCI667 or EDCI688E (as offered in Spring 2008). Formerly: EDCI688E.
An exploration of the multicultural materials and instructional strategies that create responsive K-12 classrooms and curricula for diverse readers.

EDCI 670 Trends in School Curriculum: Science (3 credits)
Recent developments in educational thinking and practice on the curriculum in science education.

EDCI 671 Teaching Science in Elementary Schools (3 credits)
Identification of problems in teaching science. Methods for improving the effectiveness of science education.

EDCI 673 Assessing, Diagnosing, and Teaching Writing (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Examines current theory, research, best practice, curricula and materials for teaching written communication in middle and secondary schools in order to survey, review and select formal and informal assessments and diagnostic strategies useful for writing teachers. Focuses on validity and reliability issues. Includes instructional planning and development of instructional materials for implementing appropriate individual, small-group and large-group instruction. English Language Learner (TESOL and SIOP) and special needs (inclusion) pupil issues considered.

EDCI 675 Learning to Teach and Learn Science (3 credits)
Prerequisite: EDCI411; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Restriction: Must be in the Maryland Master's Certification program; or permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDCI675 or EDCI788V. Formerly: EDCI788V.
Developing practices of instruction in science teaching in the context of understanding student science learning.

EDCI 676 Reflection and Practice in Secondary School Science Teaching (3 credits)
Prerequisite: EDCI675; or permission of instructor. Restriction: Must be in the Maryland Master's Certification program.
Use of classroom videotape and student work as data for teachers to analyze their students' thinking and discuss instructional interpretation, strategies, and techniques in the specific contexts of their classes.

EDCI 677 Computers in Science Education (3 credits)
Prerequisite: Must have completed EDCI487; or students who have taken courses with comparable content may contact the department.
Current and projected methods by which computers can augment classroom and laboratory-based science instruction in school and non-school settings.

EDCI 680 Teaching and Learning in Secondary Schools (3 credits)
Recent developments in educational thinking and practice which have effected the curriculum.

EDCI 682 Reframing Teacher Professionalism: Achieving Teacher Leadership (3 credits)
Understanding the profession of teaching, teacher leadership, and the knowledge base that undergirds the teaching profession. Multiple perspectives on teaching in the current debate on school reform and how they are aligned across the political spectrum.

EDCI 683 Teaching and Learning Number in the Middle Grades (3 credits)
Restriction: Admission to M.A or M.Ed. w/ concentration in Mathematics Education; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Students develop reflective, theoretical perspectives toward and practical approaches for the teaching and learning of the number system in middle school. There is an emphasis on rational numbers and its pedagogical content knowledge.

EDCI 685 Research Methods (3 credits)
The interpretation and conduct of research in curriculum and instruction.

EDCI 687 Learning with Technology (3 credits)
Review and analysis of topics related to learning with technology. Topics include but are not limited to: teaching, learning, and design theories, new and emerging technologies, innovative uses of technology in formal and informal education. Topics will vary with instructor expertise, check with instructor for specific areas of emphasis.

EDCI 688 Special Topics in Curriculum and Instruction (1-3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Current topics and issues in teaching.

EDCI 689 Teaching Internship (1-9 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 12 credits if content differs.
Internship experiences in elementary or secondary teaching with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students admitted to graduate teacher education program option.

EDCI 690 Teaching as a Profession (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
The profession of teaching and the knowledge base that defines teaching. Current and social issues that affect teaching and learning; role of research and experience in learning to teach.

EDCI 691 Models of Teaching: Theories and Applications (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Theory and research on teaching as applied to models of instruction. Practice in developing an initial repertoire of teaching models and in providing thoughtful critique of teaching based on these models.

EDCI 694 Transformative Pedagogy and School Subjects (3 credits)
Examines the potential of various pedagogoies to be transformative in relation to school subject matters, school identities, and school contexts.

EDCI 695 Teaching Science and Social Studies through Environmental Study (3 credits)
Restriction: Must be in a major within EDUC-Teaching, Learning, Policy and Leadership department.
Curriculum and instruction for science and social studies within a multicultural and environmental context; analysis of social studies and science curriculum materials; utilization of school and community resources.

EDCI 696 Conducting Research on Teaching (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Application of the knowledge base on effective teaching to the analysis and improvement of educational practice. Research methods used in the study of classroom teaching. Design and conduct of an action research project.

EDCI 697 Embracing Diversity in Classroom Communities (3 credits)
The course aims to help students understand race, class, gender, and sexuality as systems of privilege, exclusion, marginalization, and the centrality of embracing diversity in the classroom communities to promote the success of all students.

EDCI 698 Conducting Research on Teaching (1-3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 3 credits if content differs.
Application of the knowledge base on effective teaching to the analysis and improvement of educational practice. Research methods used in the study of classroom teaching. Design and conduct of an action research project.

EDCI 720 Theory and Research in Social Studies Education (3 credits)
Prerequisite: EDCI620; or EDCI622.
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 730 Language and Education (3 credits)
Dialect, language varieties in school settings; historical and current perspectives on the role of language in learning; theories of school achievement and consequences for language assessment.

EDCI 732 Second Language Acquisition (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Major theoretical approaches to second language acquisition. For teaching English to speakers of other languages (TESOL).

EDCI 734 Teaching English Language Learners: Current and Future Research Directions (3 credits)
Prerequisite: EDCI780 or EDCI732; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Research on the preparation of generalists and specialists teaching English Language Learners. Current research and future research directions.

EDCI 735 Research Foundations of Second Language Education: ExaminingLinguistically Diverse Student Learning (3 credits)
Prerequisite: EDCI630 or EDCI732; and permission of EDUC-Teaching, Learning, Policy and Leadership department. Or permission of instructor.
Critically examine theories of second language acquisition and research in applied linguistics relevant to linguistically diverse students and learners of English as an additional language. Analysis of research from linguistic, psycholinguistic, sociolinguistic and sociocultural perspectives, with an emphasis on the

social contexts of second language learning and teaching.

EDCI 740 Theory and Research in English Education (3 credits)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 745 Theory and Research in Written Communication (3 credits)
Recommended: EDCI685.
Analysis and synthesis of recent theoretical trends in writing research; the reading and critiquing of representative research studies. The study of research methods for conducting disciplined inquiry in written communication.

EDCI 751 Theory and Research on Mathematical and Scientific Thinking and Learning (3 credits)
Prerequisite: Admitted to Doctoral Program in Mathematics Education or Science Education; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Study of mathematical and scientific thinking by students at various levels of schooling considered from the perspective of those classic and contemporary theories of learning that are particularly relevant to the study of mathematics and science. Exploration of what it means to understand mathematics and science.

EDCI 752 Foundations of Mathematics Education II: Theory and Research on Mathematics Teaching (3 credits)
Prerequisite: EDCI751; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Knowledge of and insights into how mathematics has been and is being taught; theories about how it might be taught. Familiarity with the methods used to do research on teaching and to improve teaching.

EDCI 753 Foundations of Mathematics Education III: Curriculum (3 credits)
Prerequisite: Admitted to Mathematics Education Doctoral Program; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
The study of curriculum in mathematics and research on curriculum. The relationship of mathematics and school mathematics; the forms, purposes,development, and evaluation of mathematics curricula.

EDCI 754 Mathematics and Science Education Policy, Professional Development and Teacher Preparation (3 credits)
Prerequisite: Admitted to Doctoral Program in Mathematics Education or Science Education; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Preservice teacher education, professional development, and policy as agents of reform in mathematics education and in science education.

EDCI 758 Research Seminar in Mathematics and Science Education (1 credits)
Prerequisite: Admission to Doctoral Program in Mathematics or Science Education; and must have completed or be concurrently enrolled in EDCI751 or EDCI754. Repeatable to 9 credits if content differs.
Read, plan, conduct, and report on research projects and research topics in mathematics and science education. Projects may be faculty/student projects, or group or individual student projects (may or may not be related to a dissertation). Emphasis on framing researchable questions and designing/analyzing research studies. Faculty and peer feedback and interaction are crucial expectations.

EDCI 761 Advanced Clinical Practices in Reading Assessment (3 credits)
Prerequisite: EDCI665. Corequisite: EDCI762.
Clinical practicum in assessment focusing on strengths and needs in reading. Case report writing and conferences.

EDCI 762 Advanced Clinical Practices in Reading Instruction (3 credits)
Prerequisite: EDCI665. Corequisite: EDCI761.
Clinical practicum in instruction focusing on instructional techniques and diagnostic teaching.

EDCI 764 Writing Across the Curriculum (3 credits)
Emphasis on providing secondary education majors with an interdisciplinary foundation in current theory, research, and best practice focused on the teaching of writing across the curriculum, e.g.,art, English, foreign languages and TESOL, language arts, mathematics, music, sciences, and social studies. Exceptional student, inclusion, and diversity issues w ill be discussed.

EDCI 769 Theory and Research in Reading (3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 6 credits if content differs.
Survey of the literature in reading and allied fields, and an examination of current research trends and methodologies.

EDCI 770 Foundations of Science Education (3 credits)
Prerequisite: EDCI670 or EDCI671; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Development of science education; pre-kindergarten through college; the influences on current and future practices; and the identification and critical analysis of topics in science education.

EDCI 775 Seminar in Mixed Methods Research in Education (3 credits)
Prerequisite: EDMS646; and (EDCI791 or EDHI700); and permission of EDUC-Teaching, Learning, Policy and Leadership department.
Recommended: EDCI792. Credit only granted for: EDCI 788A, EDPS 788A, EDCI 775, EDPS 775. Formerly: EDCI 788A and EDPS 788A.
Examination of epistemological and methodological issues involved in conducting mixed methods studies in education. Students design and conduct analyses using existing datasets that include qualitative and quantitative data. They formulate appropriate research questions, consider alternative mixed methods designs, and address methodological complexities associated with working with qualitative and quantitative data in a single study.

EDCI 776 Urban Education (3 credits)
This seminar provides students with a broad overview of urban education as a field of inquiry by examining the social context of urban schools, how transformative pedagogy is practiced and conceptualized as well as school reform.

EDCI 780 Theory and Research on Teaching (3 credits)
Analysis of the interactive process of instruction; preschool through higher education in school and non-school settings; future directions and needed research.

EDCI 782 Power, Privilege, Diversity and Teaching (3 credits)
This course critically examines the theoretic foundation of multicultural education with particular emphasis on the relationship between power, privilege, diversity and teaching.

EDCI 783 Theory and Research in Computer Education (3 credits)
Prerequisite: EDCI687, EDMS645, and

EDCI685; or permission of EDUC-Teaching, Learning, Policy and Leadership department.
Examination of the current research and theory in the instructional uses of computers, instructional tutoring systems, computer programing environments, computer-based laboratories and problem solving environments in educational settings.

EDCI 784 Teaching, Professional Development and School Change (3 credits)
Examines currrent scholarship on professional development for K-12 teachers, characteristics of good professional development, and its relationship to teaching, learning, and school improvement.

EDCI 785 Teacher Preparation, Diversity, and Social Change (3 credits)
A critical examination of the theory and research on Teacher preparation with an emphasis on issues of race, class, gender, and sexuality and the pervasive inequalities manifest in K-12 school contexts.

EDCI 786 Black and Latino Education: History and Policy (3 credits)
Recommended: EDCI776; and completion of EDSP611 recommended.
Examination of the historical legacies and contemporary policies that have contributed to the educational status (K-20) of Blacks and Latinos in the United States from the 19th century to the present. Issues surrounding language, immigration, racism, social class, and state and federal policies will also be analyzed.

EDCI 787 Disciplinary Knowledge, School Subjects and Educational Reform (3 credits)
Examines the interrelationship between ways of knowing in disciplines and how they are represented in school subjects. Implications for the reform of teaching and teacher education are also considered.

EDCI 788 Selected Topics in Teacher Education (1-3 credits)
Repeatable to 6 credits if content differs.
Current topics and issues in teacher education.

EDCI 790 Epistemological Bases of Education Research (3 credits)
Prerequisite: EDCI780.
A course on research theory, method, and design issues for doctoral students. Focuses on conceptual and theoretical understanding of methodology, the broad rand of both qualitative and quantitative methodologies, and underlying epistemologies as they apply to the study of schools, curriculum, teaching, and teacher education.

EDCI 791 Qualitative Research I: Design and Fieldwork (3 credits)
Prerequisite: EDCI790. Formerly: EDCI684.
Builds on EDCI790 to examine in more depth the theoretical and epistemological moorings of different types of qualitative research. Students apply selected field research methods to problems of professional practice in schools and communities while considering central issues and dilemmas that arise while engaging in fieldwork.

EDCI 792 Qualitative Research II: Analysis and Interpretation of Data (3 credits)
Prerequisite: EDCI791. Credit only granted for: EDCI692 or EDCI792. Formerly: EDCI692.
Uses data collected in EDCI791 to consider methods oof on-going data analysis, ways of knowing and writing about field research, issues of reflexivity, and the ethical and political decisions involved in crafting text. Students will read literature on and exemplars of multiple modes of qualitative data analysis and interpretation.

EDCI 798 Special Problems in Teacher Education (1-6 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Intended for Masters, AGS, or doctoral students in education who desire to pursue a research problem.

EDCI 799 Master's Thesis Research (1-6 credits)

EDCI 820 Seminar in Social Studies Education (3 credits)

EDCI 822 Seminar in Secondary Education (3 credits)

EDCI 840 Seminar in English Education (3 credits)

EDCI 858 Seminar in Mathematics Education (1-3 credits)
Repeatable to 6 credits.
Survey and analysis of literature on an identified research topic in mathematics education. Design and implementation of a research study to investigate the identified topic.

EDCI 860 Seminar in Reading Education (3 credits)

EDCI 861 Research Methods in Reading (3 credits)
Current research questions and methods culminating in a study suitable for submission to journals. Emphasis on using and conducting research.

EDCI 870 Seminar in Science Education (3 credits)

EDCI 880 Doctoral Proposal Seminar (3 credits)
Prerequisite: EDCI780 and EDCI685.
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Definition of the problem, development of research design, data collection processes, and writing and critiquing dissertation proposals.

EDCI 881 Ontology and Research Among Marginalized Groups (3 credits)
Recommended: EDCI776.
Students analyze the different ways in which social inequality has been understood over time, how those understandings have shaped research of marginalized communities and how, in turn, research has shaped understandings of inequality, particularly in the area of education. Genetic difference, cultural deprivation, and social reproduction are among the theories covered in the course. Students examine both empirically- and theoretically-based works and connections between theoretical frameworks, problem-posing and methodological approaches.

EDCI 888 Apprenticeship in Education (1-8 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Apprentice practice under professional supervision. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDCI 889 Internship in Education (3-8 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department.
Internship experiences with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDCI 898 Pre-Candidacy Research (1-8 credits)

EDCI 899 Doctoral Dissertation Research (1-8 credits)

Education Counseling and Personnel Services (EDCP)

EDCP 411 Principles of Mental Health (3 credits)
Prerequisite: 9 semester hours in the behavioral sciences; or permission of EDUC-Counseling, Higher Education and Special Education department.
Mechanisms involved with personal adjustment, coping skills, and the behaviors that lead to maladjustment.

EDCP 418 Special Topics in Leadership (3 credits)
Repeatable to 6 credits if content differs.
The special topics and leadership course will address a single topic related to leadership through the semester. In-depth study and analysis on the topic will be the basis for the course. Topics include gender and leadership, ethics and leadership, and culture and leadership. Leadership will serve as the foundation in the course.

EDCP 420 Advanced Topics in Human Diversity and Advocacy (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
This course will build upon students' knowledge of diversity in American society and will examine contemporary topics related to multiculturalism in educational and community contexts as well as strategies for advocacy in such venues. This course fulfills CORE requirements in diversity.

EDCP 462 Disability in American Society (3 credits)
Restriction: Must have earned a minimum of 30 credits; and sophomore standing or higher.
Critical examination of the history of discrimination and analysis of current policies toward people with severe physical and mental disabilities.

EDCP 489 Field Experiences in Counseling and Personnel Services (1-4 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDCP 498 Special Problems in Counseling and Personnel Services (1-3 credits)
Prerequisite: Available only to major students who have formal plans for individual study of approved problems. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Available only to major students who have formal plans for individual study of approved problems.

EDCP 499 Workshops, Clinics, Institutes (1-6 credits)
Repeatable to 6 credits.
The following type of educational enterprise may be scheduled under this course heading: workshops conducted by the Department of Counseling and Personnel Services (or developed cooperatively with other departments, colleges and universities) and not otherwise covered in the present course listing; clinical experiences in counseling and testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups.

EDCP 605 Developmental Issues in Counseling Adults (3 credits)
Theoretical approaches to adult development. The scope and variety of settings (industry, education, government) in which programs of adult counseling and guidance take place, and the nature of such programs.

EDCP 610 Professional Orientation (3 credits)
Survey of knowledge base and practices in counseling and personnel services specializations, professional ethics, credentialling relevant legislation, current issues.

EDCP 611 Career Development Theory and Programs (3 credits)
Research and theory related to career and educational decisions; programs of related information and other activities in career decision.

EDCP 612 Multicultural Issues in Counseling and Personnel Services (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Socio-psychological, philosophical, clinical, and research topics related to the provision of counseling and personnel services, academic support, and career development for minority students on predominantly white college and university campuses. Implications of race and/or national origin on opportunities for personal, social, academic, and career development in educational settings.

EDCP 615 Counseling I: Appraisal (3 credits)
Corequisite: EDCP618. Restriction: Must be in a major within EDUC-Counseling, Higher Education and Special Education department.
Collection and interpretation of appraisal data, synthesis of data through case study procedures. Development of interview skills.

EDCP 616 Counseling II: Theory and Practice (3 credits)
Corequisite: EDCP618.
Counseling theories and the practices which stem from such theories.

EDCP 617 Group Counseling (3 credits)
Prerequisite: EDCP616.
A survey of theory, research and practice of group counseling and psychotherapy, with an introduction to growth groups and the laboratory approach, therapeutic factors in groups, composition of therapeutic groups, problem clients, therapeutic techniques, research methods, theories, ethics and training of group counselors and therapists.

EDCP 618 Counseling Skills: Introduction to Practicum (1-6 credits)
Corequisite: EDCP616. Repeatable to 2 credits.
Development and utilization of counseling skills.

EDCP 619 Practicum in Counseling (2-6 credits)
Prerequisite: EDCP616. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Sequence of supervised counseling experiences of increasing complexity. Limited to eight applicants in advance. Two hours class plus laboratory.

EDCP 620 Introduction to Mental Disorders (3 credits)
Credit only granted for: EDCP789W or EDCP620. Formerly: EDCP789W.
Understanding diagnosis and assessment of mental, addictive, and co-occurringmental/addictive disorders, using the diagnostic criteria of the most prevalent psychiatricdisorders as specified by the American Psychiatric Association Diagnostic and Statistical Manuals.

EDCP 625 Counseling the Chemically Dependent (3 credits)
Chemical dependency and its effects on the individual's personal, social, and work functioning. Counseling procedures for persons with drug and alcohol problems.

EDCP 627 Process Consultation (3 credits)
Prerequisite: Graduate course in group process.
Study of case consultation, systems consultation, mental health consultation and the professional's role in systems intervention strategies.

EDCP 630 School-Based Behavioral Interventions (3 credits)
Restriction: Permission of instructor; and must be in a major in EDUC-College of Education.
Behavior assessment and intervention techniques from behavioral, cognitive-behavioral, and ecological models. Planning, implementation, and evaluation of behavior change techniques.

EDCP 631 Serving Culturally and Linguistically Diverse Clients in the Schools (3 credits)
Restriction: Must be in the School Psychology or Counselor Education programs.
Conceptual and empirical literature about racially, ethnically, culturally, and linguistically diverse clients. Examination and integration of cross-cultural literature.

EDCP 632 Cognitive Assessment (3 credits)
Restriction: Must be in the School Psychology program; or permission of EDUC-Counseling, Higher Education and Special Education department.
Assessment of cognitive functioning of children and adolescents in reference to school learning and behavior problems. Administering, scoring and interpreting cognitive assessment instruments commonly used in school systems.

EDCP 633 Diagnostic Appraisal of Children I (3 credits)
Prerequisite: EDCP632.
Assessment of development, emotional and learning problems of children.

EDCP 635 School Consultation I (3 credits)
Restriction: Must be in the School Counseling program; or must be in the School Psychology program; or permission of instructor.
Theory and practice of consultation services in the school setting. Understanding of school culture. Introduction to problem solving model of case consultation for assessment and remediation of learning and behavior problems in the classroom. Practicum experience.

EDCP 636 School Consultation II (3 credits)
Prerequisite: EDCP635. Restriction: Must be in the School Psychology program; or permission of instructor.
Didactic practicum in consultation services in the school setting. Case consultation and organizational consultation in the schools. Practicum experience.

EDCP 640 School Psychology Seminar: Overview of the Specialty (1-2 credits)
Restriction: Must be in the School Psychology program; or permission of instructor.
Overviews the specialty of school psychology, including history of the specialty, roles and functions of school psychologists, and current professional issues related to the specialty.

EDCP 641 School Psychology Seminar: Professional Ethics (1-2 credits)
Restriction: Must be in the School Psychology program; or permission of instructor.
Overviews ethical issues in the specialty of school psychology.

EDCP 651 Group Counseling in Schools (3 credits)
Prerequisite: EDCP616; and for school counseling and school psychology students only. Restriction: Permission of instructor.
Issues and techniques of group counseling in schools.

EDCP 652 Research in Counseling (3 credits)
Restriction: Must be in the School Counseling program. Credit only granted for: EDCP652 or EDCP789Y. Formerly: EDCP789Y.
An exploration of basic and applied research, program evaluation, and associated measurement and evaluation skills crucial for professional school counselors.

EDCP 655 Organizational Dimensions of Student Affairs (3 credits)
Prerequisite: EDCP610; or permission of EDUC-Counseling, Higher Education and Special Education department.
Exploration of leadership and organizational change of student affairs programs in post-secondary education.

EDCP 662 Psychosocial and Medical Aspects of Disability (3 credits)
Prerequisite: EDCP610; or students who have taken courses with comparable content may contact the department.
Appraisal and understanding of the psychosocial and medical aspects of disability and chronic illness, including their nature, causes, functional aspects and treatment; understanding of how psychological and social factors influence the adjustment processes in disability.

EDCP 663 Rehabilitation and Treatment of Mental and Emotional Disorders (3 credits)
Prerequisite: EDCP610; or permission of EDUC-Counseling, Higher Education and Special Education department.
Purpose and principles of rehabilitation and treatment methods of adolescents and adults with significant mental health disorders and dual diagnoses. Focus is on the individual as well as the family. The course includes information regarding etiology, assessment, treatment interventions, program planning, and program evaluation.

EDCP 665 Family and Social Support Systems (3 credits)
Recommended: EDCP610.
Principles and methods useful for understanding the role of family support systems in counseling. Specialized skills for counseling impaired adults and their families.

EDCP 668 Special Topics in Rehabilitation (1-6 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Repeatable to 6 credits if content differs.

EDCP 669 Professional Issues in Counseling Psychology (1 credits)
Prerequisite: Open only to Counseling Psychology majors. Also offered as: PSYC669. Formerly: EDCP695.
Introduction to counseling psychology, including history and development of the field, and current professional and scientific issues. Exploration of career, research, and professional development opportunnities.

EDCP 671 Intergroup Dialogue Facilitation Practicum (3 credits)
Prerequisite: EDCP616, EDCP618, and EDCP771; or permission of instructor. Restriction: Limited to college student personnel students only. Credit only granted for: EDCP498L or EDCP671. Formerly: EDCP498L.
Developing knowledge and skills for facilitating intergroup dialogues. Using the principles and content of intergroup dialogues to create scenarios for the practice of listening, understanding, and taking action under theories of social justice.

EDCP 672 Individual and Organizational Assessment in

Student Affairs (3 credits)
An examination of the scholarship and practice of assessment of college student learning and developmental outcomes as well as organizational practices that contribute to those outcomes.

EDCP 680 Basic Didactic Practicum in Counseling Psychology (3 credits)
Prerequisite: For Counseling Psychology majors only. Formerly: PSYC776.
In depth examination of counseling theories and techniques, and supervised experience in application of a range of counseling and therapy approaches.

EDCP 682 Counseling Psychology Didactic Practicum in Group Interventions (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC682. Formerly: EDCP718.
In depth examination of theories and techniques of group interventions; supervised experience in group counseling.

EDCP 684 Counseling Psychology Didactic Practicum in Consultation (3 credits)
Prerequisite: For Counseling Psychology majors only. Formerly: EDCP789K.
In depth examination of theories and techniques of consultation on and off university campuses; supervised experience on conducting consultation.

EDCP 685 Counseling Psychology Didactic Practicum in Counseling Supervision (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC685. Formerly: EDCP745.
In depth examinatin of theories and techniques of counseling supervision, supervised experience in the process of supervising counselors.

EDCP 686 Counseling Psychology Didactic Practicum in Career Interventions (3 credits)
Prerequisite: For Counseling Psychology majors only. Formerly: EDCP777.
In depth examination of theorectical approaches and issues in career interventions; supervised experience in career counseling and assessment.

EDCP 689 Seminar in Counseling Psychology (3 credits)
Prerequisite: For Counseling Psychology majors only. Repeatable to 12 credits if content differs. Also offered as: PSYC689. Formerly: EDCP789.
Special topics in counseling psychology. Examples of topics include multicultural counseling, the counseling relationship, counseling and victimology, psychology treatment and health.

EDCP 690 Research in Counseling Psychology I (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC690. Formerly: EDCP778.
Critical analysis of strategies, methodological, conceptual, and content trends.

EDCP 691 Research in Counseling Psychology II (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC691. Formerly: EDCP717.
Critical analysis of trends and issues in counseling psychology science.

EDCP 692 Assessment in Counseling Psychology I (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC692. Formerly: EDCP789F.
Broad introduction to the construction of psychological tests and measures, and experience in test interpretation, with consideration of historical, legal, ethical, and cultural issues surrounding the assessment process.

EDCP 693 Assessment in Counseling Psychology ii (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC693. Formerly: EDCP789F.
Supervised experience in administration, scoring, and interpreting major psychodiagnostic instruments used by counseling psychologists, as well as writing integrative assessment reports. Emphasis on hypothesis testing approach to assessment and on the counseling interview as an assessment tool.

EDCP 694 Student Leadership Development (3 credits)
Credit only granted for: EDCP694 or EDCP789D. Formerly: EDCP789D.
Explores the development of leadership among college students including the study of leadership theory; a focus on how leadership is learned and developed; cultural demensions of leadership; and exposure to the current national scene in leadership associations, programs, and resources.

EDCP 695 Ethical and Professional Issues in Counseling Psychology (3 credits)
Prerequisite: Only open to Counseling Psychology majors. Also offered as: PSYC695. Credit only granted for: EDCP669, EDCP688, EDCP695, PSYC688, or PSYC695. Formerly: EDCP669 and EDCP688.
Exploration of ethical and professional issues in Counseling Psychology.

EDCP 697 Multicultural Issues in Counseling Psychology (3 credits)
Prerequisite: Only open to Counseling Psychology majors. Also offered as: PSYC697. Credit only granted for: EDCP697, EDCP699, or PSYC697. Formerly: EDCP699.
Exploration of knowledge, attitudes and skills for providing counseling and psychological services to culturally diverse populations.

EDCP 698 advanced Didactic Practicum in Counseling Psychology (3 credits)
Prerequisite: For Counseling Psychology majors only. Repeatable to 12 credits if content differs. Also offered as: PSYC698. Formerly: EDCP776.
In depth examination of approaches to or theories abouth intervention, and supervised experience in the application of those approaches or theories. Each practicum focuses on a particular approach, e.g., psychodynamic, cognitive-behavioral, cross-cultural.

EDCP 700 Theories and Strategies of Counseling Psychology (3 credits)
Prerequisite: For Counseling Psychology majors only. Also offered as: PSYC700. Formerly: EDCP789J.
Introduction to the professional field, examination of pertinent scientific and philosophical backgrounds, and survey of the major theories, principles, and training models in counseling. Correlated laboratory analogue experiences in dydactic and group interrelationships.

EDCP 715 Appraisal Measures in Counseling (3 credits)
Prerequisite: EDCP615 and EDMS646; or students who have taken courses with comparable content may contact the department.
Prerequisites: EDCP 615 and EDMS 646 or their equivalents. Interpretation and utilization in counseling of the career interest and personality measures.

EDCP 716 Advanced Counseling Theory Seminar (3 credits)
Prerequisite: Master's degree in counseling; or permission of EDUC-

Counseling, Higher Education and Special Education department.
Systematic investigation of methods of theory analysis and their application to counseling theory.

EDCP 717 Evaluation of Research in Counseling (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Research on process and outcome in counseling. A review of research and appropriate research methodologies.

EDCP 718 Advanced Seminar in Group Processes (2-6 credits)
Prerequisite: Must have completed EDCP626. Repeatable to 6 credits.

EDCP 735 Seminar in Rehabilitation Counseling (3 credits)
Part of the core curriculum for rehabilitation counselors. Designed to provide the advanced rehabilitation counseling student with a formal seminar to discuss, evaluate and attempt to reach personal resolution regarding pertinent professional problems and issues in the field.

EDCP 738 Practicum in Child Assessment (1-6 credits)
Corequisite: EDCP633 and EDCP634. Repeatable to 6 credits.
Administration of complete test batteries to children; supervision of initial interviews; test administration and scoring; interpretation and synthesis of test battery and interview material; the psychological report; verbal interpretation of test results; and recommendations. Taken initially with EDCP 633; repeated with EDCP 634 in the subsequent semester.

EDCP 740 Issues and Methods in Counselor Education (3 credits)
Restriction: Must not be in Counseling and Personnel Services (Doctoral) program.
Competencies, current issues, and methods in the pre-service and continuing education of counselors.

EDCP 741 Multicultural Practice in Student Affairs: Self, Education, and Society (3 credits)
Prerequisite: EDCP771. Credit only granted for: EDCP741 or EDCP789Z. Formerly: EDCP789Z.
Develop knowledge and skills in the area of multicultural practice in student affairs through the examination of oppression, power, and privilege and how these dynamics impact individuals, educational institutions, and societies.

EDCP 742 Examining College Environments and Outcomes (3 credits)
Prerequisite: EDMS651; or permission of instructor. Credit only granted for: EDCP742 or EDCP789K. Formerly: EDCP789K.
Explores theory and research on the impact of the college environment on undergraduate student outcomes. Discusses environmental theory and assessment, college impact theory, outcomes assessment, and implications of the above for higher education and student affairs.

EDCP 745 Supervision of Counseling (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department; and must be in a major within EDUC-Counseling, Higher Education and Special Education department.
Survey of knowledge base, research approaches, and applied skills in supervision of counseling.

EDCP 746 Clinical Supervision of Pupil Personnel Services (3 credits)
Prerequisite: Advanced Doctoral Students Only. Restriction: Permission of instructor.
Supervision of role of psychologists and counselors in school settings; applied skills in supervision of services.

EDCP 770 Service-Learning and College Student Development (3 credits)
Credit only granted for: EDCP770 or EDCP789Y. Formerly: EDCP789Y.
Historical roots, concepts, and principles of practice of service-learning in higher education; includes community service component.

EDCP 771 The College Student (3 credits)
A demographic study of the characteristics of college students as well as a study of their aspirations, values, and purposes.

EDCP 772 Research in Student Affairs (3 credits)
Prerequisite: EDCP656; or permission of instructor. Restriction: Must be in the College Student Personnel program.
Research designs and approaches to research in student development and higher education. Development of research for research competency or dissertation proposal.

EDCP 773 Designing Qualitative Research in Counseling and Student Affairs Contexts (3 credits)
Introduction to philosophical and epistemological foundations, methodologies and methods associated with qualitative research designs appropriate in student affairs and counseling contexts.

EDCP 774 Advanced Seminar in Theories of College Student Development (3 credits)
Prerequisite: EDCP771; or students who have taken courses with comparable content may contact the department.
An opportunity for in-depth study, dialogue, and reflection about theoretical frameworks for understanding the development of college students. Specific attention is given to enhancing knowledge and understanding of the development of students when social identities and their intersections are considered.

EDCP 775 Facilitating Student Learning in Higher Education (3 credits)
Prerequisite: EDCP771; or permission of EDUC-Counseling, Higher Education and Special Education department. Restriction: Must be in Counseling and Personnel Services (Doctoral) program.
Application of selected models of college student development, learning styles, and related models of instruction to the assessment of characteristics and the design of learning environments.

EDCP 776 Social Justice in Student Affairs and Higher Education (3 credits)
Prerequisite: EDCP771 or EDCP741; or permission of instructor. Restriction: Limited to college student personnel students only.
An exploration of differences, biases, assumptions, limitations, and challenge with diversity in the context of higher education and student affairs. Focusing on issues of inequities with social identity group membership and the systems of power, privilege, and oppression in society.

EDCP 778 Research Proposal Seminar (3 credits)
The development of thesis, dissertation or other research proposals.

EDCP 788 Advanced Practicum (1-6 credits)
Prerequisite: Previous practicum experience. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Individual supervision in one of the following areas: (a) individual counseling, (b) group counseling, (c) consultation, or (d) administration.

EDCP 789 Advanced Topics in Counseling and Personnel Services (1-6 credits)
Repeatable to 6 credits.

EDCP 798 Special Problems in Counseling and Personnel Services (1-6 credits)
Prerequisite: Master's AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisers may register for credit under this number.
Master's AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisers may register for credit under this number.

EDCP 799 Master's Thesis Research (1-6 credits)
Registration required to the extent of six hours for Master's thesis.

EDCP 870 Professional Issues Seminar (3 credits)
Credit only granted for: EDCP656 or EDCP870. Formerly: EDCP656.
Examination of issues that bear on professional issues such as ethics, inter-professional relationships and research.

EDCP 871 Student Affairs Doctoral Capstone Seminar (3 credits)
Prerequisite: EDCP870; or permission of instructor. Restriction: Must be in the College Student Personnel program. Credit only granted for: EDCP789I or EDCP871. Formerly: EDCP789I.
Broadening perspectives on issues in student affairs and higher education by exploring the multiple roles and responsibilities of campus administrators and faculty members.

EDCP 888 Apprenticeship in Counseling and Personnel Services (1-8 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDCP 889 Internship in Counseling and Personnel Services (1-8 credits)
Prerequisite: Open only to students advanced to candidacy for doctoral degree. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Repeatable to 8 credits if content differs.
Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDCP 898 Pre-Candidacy Research (1-8 credits)

EDCP 899 Doctoral Dissertation Research (1-8 credits)
Registration required to the extent of 12-18 hours for a Ph.D. Dissertation.

Education, Human Development (EDHD)

EDHD 400 Introduction to Gerontology (3 credits)
Multidisciplinary survey of the processes of aging. Physiological changes, cultural forces, and self-processes that bear on quality of life in later years. Field study of programs, institutions for elderly, individual elders, their families and care providers.

EDHD 401 Promoting Optimal Aging (3 credits)
Prerequisite: EDHD320; or EDHD400; or permission of EDUC-Human Development and Quantitative Methodology department. Credit only granted for: EDHD401 or EDHD641.
Theoretical, research, and applied issues related to optimal aging from psychological, biological, and societal perspectives. Group or individual projects involving direct field experiences.

EDHD 402 Social Development (3 credits)
Recommended: EDHD411.
Social Development. Critical concepts and ideas of the study of child and adolescent social development. Focus on changes in interpersonal relationships, emotions, achievement-related behavior and competence, and functioning within the broader social context.

EDHD 411 Child Growth and Development (3 credits)
Theoretical approaches to and empirical studies of physical, psychological and social development from conception to puberty. Implications for home, school and community.

EDHD 412 Infant Development (3 credits)
Infant development across domains, including perceptual, motor, cognitive, language, social and emotional functioning from pre-natal through third year of life.

EDHD 413 Adolescent Development (3 credits)
Adolescent development, including special problems encountered in contemporary culture. Observational component and individual case study.

EDHD 414 Development of the Scientific Mind Across the Lifespan (3 credits)
Recommended: EDHD320.
Study of the educational, cognitive, social, and cultural factors that underlie the development of the scientific mind across the lifespan.

EDHD 415 Promoting the Social-Emotional Competence of Young Children in Inclusive Classrooms (3 credits)
Prerequisite: EDHD314 and EDHD425; and (EDHD419 or EDSP420). Corequisite: EDSP423, EDSP424, and EDHD431. Restriction: Must be in the Professional Early Childhood/Early Childhood Special Education program; and junior standing or higher; and minimum cumulative GPA of 2.75.
Teachers must have knowledge and skill regarding how to appropriately manage the classroom so that all children, those with and without disabilities, will be able to learn from their school experiences. Classroom management extends beyond responding to student misbehavior to include a comprehensive approach to addressing the social/emotional competence of typically and atypically developing children. The goal of this course is to prepare early childhood teachers who are able to sensitively, responsively, and effectively manage a classroom of young students who are typically developing and those who have disabilities. Includes Field Experience.

EDHD 419 Human Development and Learning in School Settings (3 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 6 credits if content differs.
Advanced study of human development and learning in different phases of school program over a period of time.

EDHD 420 Cognitive Development and Learning (3 credits)
Prerequisite: EDHD320, EDHD411, PSYC341, or PSYC355; or permission of EDUC-Human Development and Quantitative Methodology department.
Current developmental theories of cognitive processes such as language, memory, and intelligence and how differences in cognitive level (infancy

through adolescence) mediate learning of educational subject matters.

EDHD 421 Peer Relations (3 credits)
Recommended: EDHD411.
Historical and theoretical underpinnings to contemporary research on peer interactions, relationships, and groups. Focus on (1) inter-dependencies of individual characteristics, social behaviors, social relationships; (2) relations between familial factors and extra-familial peer interactions and relationships; (3) normal and abnormal peer relationships; and (4) cross cultural universals and differences.

EDHD 424 Culture, School & Community: Contexts for Learning (PreK-3rd) (3 credits)
Prerequisite: EDHD425 and EDHD314; and (EDHD419 or EDSP420). Corequisite: EDSP315, EDHD431, EDHD415, and EDSP423. Restriction: Must be in the Professional Early Childhood/Early Childhood Special Education program; and junior standing or higher; and minimum cumulative GPA of 2.75.
Explores the development of the young child (with and without disabilities, as well as those at environmental risk) in the context of the family and community, with emphasis on the impact of state, federal and school system policy on the child's world. Course will consider issues within the family, and the wider socio-cultural ecology that relate to the child's ability to develop and learn. In addition, students will develop strategies for respectful and culturally responses approaches to actively engage families in their children's development and learning. Includes Field Experience.

EDHD 425 Language Development and Reading Acquisition (3 credits)
This course focuses on young children's language development and the relationship between language and reading acquisition. Students will learn: concepts central to language development; language achievements at different ages; concepts of emergent literacy; models of reading acquisition and skilled reading.

EDHD 426 Cognition and Motivation in Reading: Reading in Content Areas I (3 credits)
Students preparing for secondary teaching will learn the cognitive and motivational aspects of reading and learning from text in subjects of literature, science, history and mathematics. Different structured approaches to using text for content learning are presented. Classroom contexts that enable students to engage productively with diverse texts and internet resources are identified.

EDHD 427 Constructing and Integrating the Early Childhood Curriculum (3 credits)
Prerequisite: EDHD314, EDHD313, EDHD424, and EDSP470. Corequisite: EDHD323, EDHD322, EDHD315, EDHD321, and EDHD435. Restriction: Must be in Early Childhood Education program; and senior standing.
Explores the world from the child's perspective and constructs curriculum based on cognition, learning, and children's experiences. The integrated curriculum is the overarching framework for this course. Includes field experience.

EDHD 430 Adolescent Violence (3 credits)
Prerequisite: PSYC100; or permission of EDUC-Human Development and Quantitative Methodology department.
Examines the roots of violence among adolescents and the extent to which this constitutes a problem in various settings. Research studies on its origins, prevention and intervention and implications for social policy are examined.

EDHD 431 Child Development and Learning, Three to Eight Years (3 credits)
Prerequisite: Minimum grade of C- in EDHD314 and EDHD425; and 1 course with a minimum grade of C- from (EDHD419, EDSP420). Corequisite: EDSP423 and EDSP315; and TRACK I: Must be concurrently enrolled in EDSP430, EDSP433; or TRACK 2: Must be concurrently enrolled in EDHD415, EDHD424.
Provides a basic understanding of child development theory and research, as well as specific knowledge about the development of children during the early and middle childhood "stages," specifically from ages 3 years to 8 years. A major emphasis will be the application of theory and research from the field of educational psychology to an understanding of how young children learn and achieve academically. Because the course will address the developmental and academic functioning of children with and without disabilities, a particular focus will be on individualization.

EDHD 432 Student Teaching Pre-K-3 (12 credits)
Prerequisite: EDHD323, EDHD322, EDHD321, EDHD435, and EDHD427. Corequisite: EDCI464. Restriction: Must be in Early Childhood Education program; and senior standing or higher.

EDHD 435 Effective Components of the Early Childhood Classroom (3 credits)
Prerequisite: EDHD419, EDHD314, EDHD313, EDHD424, and EDSP470. Corequisite: EDHD323, EDHD322, EDHD315, EDHD321, and EDHD427. Restriction: Must be in Early Childhood Education program; and senior standing or higher.
Explores three topics integral to effective, child-centered early childhood classrooms: assessment, classroom management and parent involvement. Includes field experience.

EDHD 436 Cognition and Motivation in Reading: Reading Acquisition for Middle School Students (3 credits)
Cognitive and motivational processes of reading and learning from texts across subjects. Structured approaches to using text for content learning based on approaches to knowledge, motivation, and strategies. Classroom contexts that enable middle school students to engage with diverse texts and Internet resources are provided.

EDHD 437 EC/ECSE Teachers as Researchers and Reflective Practitioners (3 credits)
Prerequisite: Minimum grade of C- in EDHD322, EDHD323, EDSP321, EDSP417, EDHD441, EDHD442, EDHD443, and EDHD444. Corequisite: EDHD432.
Students use action research to improve instructional delivery or familial interactions in an effort to enhance the overall educational experiences/outcomes of children in classrooms or home-based contexts. Students will design and implement an action research project in an effort to meet a goal articulated in an applicable Individualized Education Plan (IEP) or Individualized Family Service Plan (IFSP) or School Improvement Plan (SIP) as the basis of their project.

EDHD 440 Adult Development (3 credits)
Prerequisite: EDHD320; or permission of EDUC-Human Development and Quantitative Methodology department.
Recommended: EDHD413.
Major conceptual approaches to the study of adult development including physical, cognitive, social, emotional and self processes that take place within individuals as they progress from emerging adulthood through middle age.

EDHD 441 Data Driven Decision Making in EC/ECSE (1 credits)
Prerequisite: Minimum grade of C- in EDSP423, EDHD431, and EDSP315; and TRACK I: Must have completed EDSP430 and EDSP433 or TRACK 2: Must have completed EDHD415 and EDHD424. Corequisite: EDHD322, EDHD323, EDSP321, EDSP417, EDHD442, EDHD443, and EDHD444.
Students will be exposed to formative (e.g., classroom based, ongoing) and summative (e.g., standardized testing) assessments. Students will collect and analyze formative assessment data from their internship classrooms as the bases

of planning and delivering instruction to meet the diverse needs of all learners. They will also analyze standardized assessment data to gain an understanding of measures used to determined cross-school and cross-teacher effectiveness. Includes Phase I field experience.

EDHD 442 Interventions for Children with Behavioral Challenges (1 credits)

Prerequisite: Minimum grade of C- in EDSP423, EDHD431, and EDSP315; and TRACK I: Must have completed EDSP430 and EDSP 433; or TRACK 2: Must have completed EDHD415 and EDHD 424. Corequisite: EDSP321, EDSP417, EDHD322, EDHD323, EDHD441, EDHD443, and EDHD444.
Students will expand knowledge of and develop skills to address challenging behaviors in inclusive early childhood classrooms. Students examine the causes underlying challenging behaviors during the early childhood years, and identify appropriate resources and support services for working with families to develop a unified approach when responding to behavioral challenges. Includes Phase I field experience.

EDHD 443 Interventions for Children with Social and Communication Challenges (1 credits)

Prerequisite: Minimum grade of C- in EDSP423, EDHD431, and EDSP315; and TRACK I: Must have completed EDSP430 and EDSP 433; or TRACK 2: Must have completed EDHD415 and EDHD 424. Corequisite: EDHD322, EDSP321, EDSP417, EDHD323, EDHD441, EDHD442, and EDHD444.
Students will learn about the characteristics of children with autism spectrum disorder, pervasive developmental disorder, social communication disorder, and other related challenges and will be equipped to meet the needs of this group of children in the early childhood classroom. The utilization of Universal Design for Learning (UDL), Response to Intervention (RTI) and other early childhood special education approaches, as they apply to this specific group of children, will be addressed. Interventions designed to improve the functioning of children with autism spectrum disorders and related disorders will be reviewed. Includes Phase I field experience.

EDHD 444 Action Research in EC/ECSE (1 credits)

Prerequisite: Minimum grade of C- in EDSP423, EDHD431, and EDSP315; and track 1: Must have completed EDSP430 and EDSP433; OR Track 2: Must have completed EDHD415 and EDHD424. Corequisite: EDHD322, EDHD323, EDHD441, EDHD442, EDHD443, EDSP417, and EDSP321.
Students will become familiar with the EC/ECSE research process, literature and how teachers use action research to improve pedagogy and the experiences of children in classrooms or home-based contexts. Students will utilize this knowledge, as well as either a goal in an Individualized Education Plan (IEP) or Individualized Family Service Plan (IFSP) or School Improvement Plan (SIP), to develop an action research study commenced during the following semester. Includes Phase I field experience.

EDHD 445 Guidance of Young Children (3 credits)

Prerequisite: PSYC100; or permission of EDUC-Human Development and Quantitative Methodology department.
Practical aspects for helping and working with children, drawing on research, clinical studies, and observation. Implications for day care and other public issues.

EDHD 460 Educational Psychology (3 credits)

Prerequisite: PSYC100; or permission of EDUC-Human Development and Quantitative Methodology department.
Application of psychology to learning processes and theories. Individual differences, measurement, motivation, emotions, intelligence, attitudes, problem solving, thinking and communicating in educational settings.

EDHD 489 Field Experiences in Education (1-4 credits)

Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 4 credits.
Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDHD 498 Special Problems in Education (1-3 credits)

Prerequisite: Available only to students who have definite plans for individual study of approved problems.
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.
Available only to students who have definite plans for individual study of approved problems.

EDHD 499 Workshops, Clinics, and Institutes (1-6 credits)

Repeatable to 6 credits.
The following types of educational enterprise may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDHD 600 Introduction to Human Development and Child Study (3 credits)

An overview of the multidisciplinary, scientific principles which describe human development and behavior and an application of these principles in an analysis of a behavioral record. Techniques of observation, recording, and analysis of human behavior. Emphasis on critiquing and applying research findings.

EDHD 601 Biological Bases of Behavior (3 credits)

Prerequisite: Must have completed or be concurrently enrolled in EDHD600; or permission of EDUC-Human Development and Quantitative Methodology department.
Emphasizes that understanding of human life, growth and behavior depends on understanding physical processes. Application throughout is made to brain-behavior relationships and implications for understanding and working with people.

EDHD 602 Social Bases of Behavior (3 credits)

The social forces and expectations that influence behavior from infancy through old age and death. The effects of ethnicity, social learning values, attitudes, historical events and mass media on perception and behavior in societal interactions.

EDHD 605 Curriculum in Early Childhood Education (3 credits)

Curriculum theory, research and practice in educational settings for infants and children to age eight.

EDHD 611 Cultural and Contextual Influences on the Young Child (3 credits)

Theory and research on social and cultural influences in early child development.

EDHD 612 Teaching Strategies in Early Childhood (3 credits)

Restriction: Must not have completed EDCI612. Credit only granted for: EDHD612 or EDCI612. Formerly: EDCI612.
Theory and research of teacher-student interaction. Analysis of planning, organization of learning environments, evaluation of learning, and interpersonal relationships.

EDHD 616 Teacher-Parent Relationships (3 credits)

Credit only granted for: EDHD616 or EDCI613. Formerly: EDCI613.

Research in parental involvement in school activities and processes.

EDHD 617 Achievement Motivation in Adolescence (3 credits)
Credit only granted for: EDHD779W or EDHD617. Formerly: EDHD779W.
Study of different aspects of motivation and how they develop in the secondary school years. Focus on how different instructional practices influence motivation and design of various strategies for improving students motivation.

EDHD 619 Advanced Scientific Concepts in Human Development (3 credits)
Repeatable to 6 credits if content differs.
A critical examination of concepts and issues in contemporary culture as these relate to the development and learning of children and youth.

EDHD 624 Cognitive and Motivational Bases of Reading; Reading in Content Areas I and II (6 credits)
Credit only granted for: EDHD624 or EDHD779G. Formerly: EDHD779G.
Fundamental processes of student engagement in reading for secondary teachers. Processes related to how middle school and high school students gain knowledge in content fields, how students learn and use strategies for gaining knowledge, and motivations for learning from a variety of texts.

EDHD 629 Seminar for the Center for Children, Relationships, and Culture (1 credits)
Recommended: For graduate students in Human Development. Repeatable to 8 credits if content differs.
A seminar and colloquia series featuring speakers from the department, the college, the university, and other universities and institutions from across the world that aims to cover issues pertaining to contemporary theory and research in human development.

EDHD 630 Cognitive Processes During Aging (3 credits)
Cognitive functioning of the aged. The roles of cultural, environmental and affectional variables as they contribute to the healthy functioning of cognitive processes. On-site field trips.

EDHD 635 Adolescents at Risk (3 credits)
Recommended: EDHD600. Credit only granted for: EDHD635 or EDHD779L. Formerly: EDHD779L.
Study of current research on risky behaviors that impact adolescent student learning and achievement particular in underserved populations. General diversity issues and topics specific issues that put adolescents at risk for academic failure and other negative trajectories will be explored.

EDHD 659 Direct Study of Individuals (3 credits)
Observational techniques to record the behavior of an individual. Procedures to ensure objectivity in data collection. Methods used to analyze, categorize, quantify observational data in research.

EDHD 662 Research Methods in Education Settings (3 credits)
Research methods associated with studying the development, achievement, and school adjustment of children and adolescents in educational settings, with an emphasis on quantitative methodologies.

EDHD 674 Self Processes in Adolescence: Implications for Academic Achievement and School Adjustment (3 credits)
Credit only granted for: EDHD619L or EDHD674. Formerly: EDHD619L.
Study of the development of the self from infancy through adolescence, and examination of the literature on the self processes of special adolescent populations as they relate to achievement-related orientations and school adjustment in secondary settings.

EDHD 690 History and Systems in Human Development (3 credits)
History of the field of human development; philosophical basis of major theoretical paradigms and contemporary research drawn from foundational traditions.

EDHD 692 Cognitive Basis of Instruction (3 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.
Psychological and educational research literature on human cognition, especially as applied to learning and teaching in classroom settings.

EDHD 700 Infant Development (3 credits)
An examination of recent research findings in physical, social, emotional and language development during infancy. A review of prenatal and perinatal factors in relation to their influence on later development.

EDHD 711 Peer-Culture and Group Processes in Human Development (3 credits)
Prerequisite: Permission of EDUC-Human Development and Quantitative Methodology department.
The process of group formation, role-taking and status-winning, and the emergence of the peer-culture during childhood and the evolution of the child society at different maturity levels to adulthood. The developmental tasks and adjustment problems associated with winning, belonging, and playing roles in the peer group.

EDHD 712 Education and Group Care (3 credits)
Prerequisite: EDMS645; or permission of EDUC-Human Development and Quantitative Methodology department. Credit only granted for: EDHD711 or EDCI712. Formerly: EDCI711.
The historical, theoretical and empirical basis for the group care and education of young children with special emphasis on the child under the age of three.

EDHD 713 Research in Early Childhood Education (3 credits)
Prerequisite: EDMS645; or permission of EDUC-Human Development and Quantitative Methodology department. Credit only granted for: EDHD713 or EDCI713. Formerly: EDCI713.
The design and conduct of research with infants and children to age eight; reviews, evaluations and discussions of significant and relevant early childhood research literature.

EDHD 718 Apprenticeship in College Teaching (1 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.
For graduate students teaching autonomously for the first, second, or third tiem at the University of Maryland, College Park; not intended for teaching assistants. This course provides graduate student teachers with a set of structured experiences that foster professional growth and development in the role of college instructor. Includes seminars on the scholarship of college teaching and principles of optimal college classroom environments, peer and faculty in-class observations of teaching, and guided reflective analysis of experience in the classroom.

EDHD 720 Social Development and Socialization Processes (3 credits)
This course covers social development and socialization processes across the life-span. The course typically covers the following topics: parent-child relationships, peer relationships, moral development, social cognition, social competence, social motivation, self-regulation, and cultural influences on development. This is core doctoral course.

EDHD 721 Cognitive Development and Learning: An

Introduction (3 credits)
Introductory survey into contemporary theory and research in cognitive development; applications to classroom learning.

EDHD 722 Learning Theory and the Educative Process (3 credits)
Prerequisite: EDHD721; or permission of EDUC-Human Development and Quantitative Methodology department.
Advanced study of theories, issues and research in several categories of cognition and learning applied to education and the helping professions.

EDHD 750 Culture, Context, and Development (3 credits)
This course will cover theory and research on cultural and contextual influences on social development.

EDHD 751 Child Development and Poverty (3 credits)
Prerequisite: EDHD720; or permission of EDUC-Human Development and Quantitative Methodology department.
This course examines the theoretical, methodological, and empirical literature on the effects of poverty on children's development from a multidisciplinary perspective. It includes basic concepts in methodology, measurement design, and issues related to connecting basic research on poverty and children to policy and program interventions.

EDHD 760 Advanced Educational Psychology (3 credits)
Prerequisite: Prior course in educational psychology, learning, or cognition; or permission of EDUC-Human Development and Quantitative Methodology department.
Appplication of psychology to learning processes and theories. Individual differences, measurement, motivation, and intelligence.

EDHD 768 Laboratory Methods in Developmental Psychophysiology (3 credits)
Recommended: EDHD775. Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Covers basic electrophysiology and human electrophysiology. Topics include recording, processing, and analyzing EEG and ERP. Emphasis will be placed on the testing of infant and child populations.

EDHD 770 Designing Multimedia Computer Environments for Learners (3 credits)
This course focuses on how new computer technologies for learners can be created and used in an educational setting. Small group design projects, discussions, and readings will be required.

EDHD 775 Human Development and Neuroscience (3 credits)
Prerequisite: EDHD601; or permission of EDUC-Human Development and Quantitative Methodology department.
Course focuses on the biological bases of human behavior including physiological processes which have an impact on human development.

EDHD 779 Selected Topics in Human Development (1-6 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 6 credits if content differs.
This course focuses on topics of current significance in human development research. Topics covered change each semester, and vary by instructor.

EDHD 780 Research Methods in Human Development (3 credits)
Prerequisite: EDMS651; or permission of EDUC-Human Development and Quantitative Methodology department.
Research methodology for studying human development: research design, hypothesis formulation, instrument development, methodological and statistical approaches, survey of methodologies.

EDHD 789 Internship in Human Development (3-8 credits)
Prerequisite: 9 credits in EDHD courses. Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 9 credits.
Internship experience in one or more human service agencies in the community.

EDHD 798 Laboratory in Human Development (1-6 credits)
Repeatable to 9 credits if content differs.
Independent research supervised by an instructor in a research setting.

EDHD 799 Master's Thesis Research (1-6 credits)
Registration required to the extent of six hours for master's thesis.

EDHD 800 Seminar in Early Childhood Education (3 credits)
This seminar explores relevant current issues in early childhood development and education.

EDHD 820 Advanced Topics in Social Development (3 credits)
Prerequisite: EDHD720; or permission of EDUC-Human Development and Quantitative Methodology department. Credit only granted for: EDHD820 or EDHD821. Formerly: EDHD821.
Advanced doctoral seminar on socialization and social development with consideration of selected topics. Identification of research problems and areas of application.

EDHD 830 Self Processes in Human Development I (3 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.
Doctoral core course focused on personality theories -- their history, constructs, and methods; examination of the reciprocal relation between self and the social environment; consideration of different conceptualization of self-processes and related personality research.

EDHD 835 The Development of Achievement Motivation (3 credits)
Prerequisite: EDHD830 or EDHD721; or permission of EDUC-Human Development and Quantitative Methodology department.
Development of achievement motivation and how it relates to academic achievement during the elementary and secondary school years. Expectancy-value theory, attribution theory, self-efficacy theory, socialization of achievement motivation.

EDHD 840 Language and Literacy Development (3 credits)
Content of this course is current theoretical and empirical research on children's language developments and on the linguistic basis of beginning reading.

EDHD 842 Learning in Context (3 credits)
Prerequisite: EDHD721.
Educational and home context that influence development of motivation, cognitive strategies, and knowledge will be explored.

EDHD 850 Social Cognition and Moral Reasoning (3 credits)
Theory and research on social-cognition development and moral development, from infancy to adolescence will be covered.

EDHD 870 The Role of Research in Current Federal Initiatives in Early Childhood Education and Development (3 credits)
This course focuses on the ways in which child development and early education

research supports and directs federal initiatives regarding early childhood.

EDHD 872 Young Children at Environmental Risk: Developmental and Intervention Issues (3 credits)
Examination of impact of poverty on young children, their families, and communities. Epidemiological, physiological, and sociological studies will be reviewed.

EDHD 875 Advanced Human Development and Neuroscience (3 credits)
Prerequisite: EDHD775; or permission of EDUC-Human Development and Quantitative Methodology department. Credit only granted for: EDHD811 or EDHD875. Formerly: EDHD811.
Advanced doctoral seminar in the biological bases of behavior. Identification of research problems and areas of application.

EDHD 878 Applied Research and Strategies (3 credits)
Prerequisite: EDMS651; or permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 6 credits if content differs.
Examine current human development research literature, define a research problem and design and implement a research study or review in collaboration with faculty.

EDHD 888 Apprenticeship in Human Development Research (1-8 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.
Apprenticeship in Human Development research.

EDHD 889 Practicum in Human Development (3-9 credits)
Prerequisite: Credit not to be granted for experience accrued prior to registration; and open only to degree and certificate-seeking graduate students. Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 9 credits if content differs.
Field experience in applied human development at a professional level of competence in a particular role with appropriate supervision.

EDHD 898 Pre-Candidacy Research (1-8 credits)

EDHD 899 Doctoral Dissertation Research (1-8 credits)
Registration required to 12-18 hours for a Ph.D. dissertation.

Education Leadership, Higher Ed and International Ed (EDHI)

EDHI 488 Special Topics in Education Policy and Administration (1-3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Repeatable to 6 credits. Formerly: EDPL488.
Special and intensive treatment of current topics and issues in education policy and administration.

EDHI 489 Field Experiences in Education (1-4 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Formerly: EDPL489.
Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDHI 498 Special Problems in Education (1-3 credits)
Prerequisite: Available only to students who have definite plans for individual study of approved problems. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Formerly: EDPL498.
Available only to students who have definite plans for individual study of approved problems.

EDHI 499 Workshops, Clinics, and Institutes (1-6 credits)
Repeatable to 6 credits. Formerly: EDPA499.
The following type of educational enterprise may be scheduled under this course heading: Workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals, and supervisors.

EDHI 600 Education and Society (3 credits)
Credit only granted for: EDHI600, EDPL600, or EDPS600. Formerly: EDPL600.
Education and Society is an introductory course to graduate studies in the Department of Education Policy and Leadership. Students consider how social institutions influence -- and in turn are influenced by -- education policies and practices.

EDHI 605 Comparative Education (3 credits)
Credit only granted for: EDHI605, EDPL605, or EDPS605. Formerly: EDPL605.
Analyzes and compares leading issues in education in various countries of the world, particularly as they relate to crucial problems in American education.

EDHI 606 Political Economy of Education in a Global Context (3 credits)
Credit only granted for: EDHI606, EDPL606, or EDPS606. Formerly: EDPL606.
Examination of alternative economics perspectives and their implications for education policy and practice internationally, from local to global levels. The connection of education to issues of development, inequality, poverty, gender, and race will be discussed.

EDHI 607 Culture and Education in a Global Context (3 credits)
Credit only granted for: EDHI607, EDPL607, or EDPS607. Formerly: EDPL607.
Examines cultural theories and analyzes cultural influences in education. Course materials and discussion critically analyze cultural transmission and schooling practices. Also examined are politics of culture, multiculturalism, global cultural clashes, and educators as critical culture workers.

EDHI 608 Gender and Education (3 credits)
Credit only granted for: EDPL788B or EDPL608. Formerly: EDPL608.
The course examines feminist theories on gender inequity, and analyzes social impacts on girls' and women's education. Also examined are women's ways of knowing, issues of race and class, gender and development, ecofeminism, and technology for women.

EDHI 630 Analyzing Systemwide Education Policy (3 credits)
Credit only granted for: EDHI630, EDPL630, or EDPS630. Formerly: EDPL630.
Analysis of how assessments are made of systemwide education policy based on the approaches used in studies of national education policy by international agencies.

EDHI 640 Introduction to Educational Leadership (3

credits)
Credit only granted for: EDHI640, EDPL640, or EDPS640. Formerly: EDPL640.
The focus of this course is the analysis of the role of education administrators/leaders in the social, political, and legal contexts of schools. Also examines the role of leadership in school improvement.

EDHI 641 Planning and Goal Setting In Educational Organizations (3 credits)
Credit only granted for: EDHI641, EDPL641, or EDPS641. Formerly: EDPL641.
Essential aspects of planning for educational organizations addressed through case studies in instructional programming, community involvement, fiscal and physical planning.

EDHI 642 Management of Change in Educational Organizations (3 credits)
Credit only granted for: EDHI642, EDPL642, or EDPS642. Formerly: EDPL642.
Role of individual as a change agent; issues related to effecting change within organizational sub-systems and total systems are considered. Specific strategies for successful change in schools are addressed.

EDHI 643 Management of Human Resources In Education (3 credits)
Credit only granted for: EDHI643, EDPL643, or EDPS643. Formerly: EDPL643.
Examination of knowledge and development of awareness and capabilities needed by educational leaders to promote student success by managing school system personnel needs. Emphasis on recruitment, selection and supervision as well as labor relations and collective bargaining.

EDHI 645 Leading Instructional Improvement (3 credits)
Credit only granted for: EDHI645, EDPL645, or EDPS645. Formerly: EDPL645.
Development of knowledge and skills in the use of data bases, research findings and models of supervision, to improve instruction in schools.

EDHI 646 Leading Instructional Excellence (3 credits)
Prerequisite: EDHI645; or permission of instructor. Credit only granted for: EDHI646, EDPL646, or EDPS646. Formerly: EDPL646.
Leader's role in fostering high quality teaching and learning. Exploration of the relationship between curriculum instruction assessment and the organizational structure of K-12 public schooling. Development and assessment of frameworks for understanding instructional quality. Analysis of strategies for supporting teachers as they engage in curricular and professional development. Consideration of factors involved in creating and sustaining instructionally centered schools.

EDHI 647 Context for Teaching and Learning (3 credits)
Prerequisite: EDHI645 and EDHI646; or students who have taken courses with comparable content may contact the department. Credit only granted for: EDHI647, EDPL647, or EDPS647. Formerly: EDPL647.
Links between schooling and its social and cultural context provide the theoretical grounding for examination of current theories and practices for teaching and student learning that promote equity, diversity and school success.

EDHI 650 Professional Seminar in Higher and Adult Education (3 credits)
Credit only granted for: EDHI650, EDPL650, or EDPS650. Formerly: EDPL650.
Introduction to higher and adult education as a field of study. Origins, current dimensions and problems, and emerging issues. Field trips to state and national capitols, and involvement in professional conferences.

EDHI 652 Higher Education in American Society (3 credits)
Credit only granted for: EDHI652, EDPL652, or EDPS652. Formerly: EDPL652.
Examines the concepts of academic freedom, corporate autonomy and institutional accountability with emphasis on twentieth century relationships between higher education and government in the United States.

EDHI 653 Organization and Administration of Higher Education (3 credits)
Credit only granted for: EDHI653, EDPL653, or EDPS653. Formerly: EDPL653.
Basic concepts and terminology related to organizational behavior and institutional governance structures. The governance and organization of higher education in the United States.

EDHI 654 The Community and Junior College (3 credits)
Credit only granted for: EDHI654, EDPL654, or EDPS654. Formerly: EDPL654.
Historical development and philosophical foundations of community and junior colleges in America with emphasis on organizational and administrative structures in two year institutions and the clientele they serve.

EDHI 657 History of Higher Education in the United States (3 credits)
Credit only granted for: EDHI657, EDPL657, or EDPS657. Formerly: EDPL657.
History of higher education in America from colonial times to the present with emphasis on expansion of higher education and the growing complexity of its structures, organization, and purposes.

EDHI 660 Retention Theories and the Impact of College (3 credits)
Credit only granted for: EDHI660, EDPL660, or EDPS660. Formerly: EDPL660.
An introduction to retention theories an the college impact literature. The primary focus will be to examine the disciplinary and philosophical frameworks that have informed the development of leading theories and policies.

EDHI 662 Research on Ethnic Minorities and Demographic Trends in Higher Education (3 credits)
Credit only granted for: EDHI662, EDPL662, or EDPS662. Formerly: EDPL662.
Current research on ethnic minority student populations including issues of access, campus climate, racial identity, achievement and motivation. In addition to student issues, course examines issues for faculty of color in higher education, curriculum and teaching, and leadership and governance. The application of broad demographic changes in the nation and their impact on higher education over time.

EDHI 663 Philanthropy and Fundraising in Higher Education (3 credits)
Credit only granted for: EDHI663 or EDHI788D. Formerly: EDHI788D.
A critical look at how philanthropy and fundraising has affected American Higher Education. Topics will include: a history and overview of philanthropy, motivations of and traditions of giving in different populations, ethics, and critical issues within educational and advancement.

EDHI 664 The College Experience (3 credits)
Restriction: Permission of instructor. And must be in a major within EDUC-Counseling, Higher Education and Special Education department; or must be in a major within EDUC-Education Policy and Leadership department; or must be in a major within EDUC-Teaching, Learning, Policy and Leadership department. Credit only

granted for: EDHI664, EDPL664, or EDPS664. Formerly: EDPL664.
Designed to provide students with an overview of the research and scholarship on two of the major stakeholders in higher education -- students and faculty. Examines the educational experiences of college students in and out of the classroom in higher education in the United States by focusing on what students learn and the different collegiate experiences that influence their learning.

EDHI 665 College Access and Choice (3 credits)
Credit only granted for: EDHI665 or EDHI788L. Formerly: EDHI788L.
Examines the college-going process, how and why some students successfully navigate it, and what policies and programs can help students from disadvantaged or underrepresented backgrounds overcome barriers to college access and entry.

EDHI 666 The Academic Profession (3 credits)
Credit only granted for: EDHI666 or EDHI788P. Formerly: EDHI788P.
Explores how faculty demographics, discipline, graduate socialization, and organizational context (institutional type, mission, and culture) matter to critical higher edcuation outcomes, such as student learning, community engagement, research, shared governance and access and equity.

EDHI 667 Women in Higher Education (3 credits)
Credit only granted for: EDHI667 or EDHI788A. Formerly: EDHI788A.
A comprehensive overview of the history, present condition, and current research on women students, faculty, adminstrators, and staff in higher education. Explores why and how women and men experience higher educaton differently, by drawing on historical, cultural, and psychological contexts, feminist theoretical and research perspectrives and recent research in various disciplines.

EDHI 670 Learning Communities (3 credits)
Credit only granted for: EDHI670, EDPL670, or EDPS670. Formerly: EDPL670.
Reviews contemporary research on student and teacher learning and schools as learning organizations. It aims to build students understanding of opportunities and challanges to implementing learning environments in various educational organizations. Readings, cases and assignments emphasize students' understanding of learning theories and their application to various organizational settings.

EDHI 671 Education Law and Policy (3 credits)
Credit only granted for: EDHI671, EDPL671, or EDPS671. Formerly: EDPL671.
An examination of the way judicial interpretation of common, statutory, and constitutional law shapes and constrains educational policy making. Special emphasis on topics framed under the headings of liberalism and legalism.

EDHI 672 Modes of Inquiry in Education Research (3 credits)
Credit only granted for: EDHI672, EDPL672, or EDPS672. Formerly: EDPL672.
Introduction to modes of inquiry appropriate to research on issues and problems in education. Examination of qualitative, quantitative and mixed research methods and designs with a focus on related standards of quality.

EDHI 673 Economic Evaluation of Education (3 credits)
Credit only granted for: EDHI673, EDPL673, or EDPS673. Formerly: EDPL673.
Examination and application of economic approaches - cost, cost-effectiveness, and cost-benefit analysis - to the evaluation of education programs and policies.

EDHI 674 Minority Serving Institutions (3 credits)
Credit only granted for: EDHI674 or EDHI788Q. Formerly: EDHI788Q.
Definitions and designations of Minority Serving Institutions vary; however they traditionally include Historically Black Colleges and Universities, Hispanic-Serving Institutions, and Tribal Colleges and Universities. Exploring these institutions as well as some non-traditional MSIs including, Deaf Serving Institutions and Asian American and Pacific Islander Serving Institutions.

EDHI 677 Ranking System in Higher Education: How They Work and Why They Matter (3 credits)
Credit only granted for: EDHI677 or EDHI788W. Formerly: EDHI788W.
A critical examination of domestic and international university rankings systems from their historic origins to current day. Students explore the criteria used to identify quality, the methods used to collect data, and the impact of ranking systems on institutional decision-making.

EDHI 679 Master's Seminar (3 credits)
Formerly: EDPL679.
Directed study for master's degree students writing seminar papers.

EDHI 680 Gender, Development, and Education (3 credits)
Credit only granted for: EDHI674, EDHI680 or EDHI788K. Formerly: EDHI788K.
Focusing on gender as an analytical frame and a discrete variable, a comprehensive view of the relationship between gender and education in the context of national development is presented. It identifies the conditions of men and women's education and policy efforts to promote equity and social transformation.

EDHI 681 Education for Global Peace (3 credits)
Credit only granted for: EDHI681, EDPL681, or EDPS681. Formerly: EDPL681.
This course will examine how education can address the threats of violence and wars. It prepares students to teach about peace, nonviolence, and conflict resolution, and also to analyze and implement changes in school and society to contribute to peace and non-violence.

EDHI 682 Ecological Ethics and Education (3 credits)
Credit only granted for: EDHI682 or EDHI788E. Formerly: EDHI788E.
An exploration of the paradigms, approaches, and ways of knowing offered through ecological ethics and environmental sustainability education.

EDHI 683 World Religions and Their Implications for Education (3 credits)
Credit only granted for: EDHI683 or EDHI788C. Formerly: EDHI788C.
Students develop a basic understanding of world religions, looking at their orgins, development, teachings, and primary figures. Students explore the roles, meaning, purpose that education plays in the various religions and examine their implications for education in the 21st century.

EDHI 684 Alternative Education, Alternative Development (3 credits)
Recommended: EDHI606. Credit only granted for: EDHI684 or EDHI788D. Formerly: EDHI788D.
A critical examination of the political economy of education and international development policies and practices. Focus is on the implications of these critiques for alternative education and development policies and practices.

EDHI 689 Practicum In Educational Administration and Supervision (1-3 credits)
Repeatable to 3 credits if content differs. Formerly: EDPL689.
Promotes skill development in managerial, leadership and supervisory areas. Practicum is based on results of diagnostic instruments and an individual professional development plan.

EDHI 700 Qualitative Research Methods in Education (3 credits)
Credit only granted for: EDHI700, EDPL700, or EDPS700. Formerly: EDPL700.
Qualitative methods in education research, emphasizing the paradigms of philosophy, history, sociology, anthropology, and comparative studies as they rely on narrative rather than quantitative ordering of data.

EDHI 701 Applied Research and Data Based Decision Making (3 credits)
Prerequisite: Introductory knowledge of statistics. Credit only granted for: EDHI701, EDPL701, or EDPS701. Formerly: EDPL701.
Examines quantitative research methodologies and data systems used by ed ucation researchers and leaders to investigate, develop and improve scho ol policies and practices.

EDHI 702 Advanced Seminar in Research Methods for Education Leaders (3 credits)
Prerequisite: EDHI672 and EDHI701. Credit only granted for: EDHI702, EDPL702, or EDPS702. Formerly: EDPL702.
Emphasizes the application of quantitative and qualitative research methodologies to investigate a range of issues relevant to education leaders, including educational equity, efficiency, and effectiveness. Students enroll in either the qualitative or quantitative section of the course, depending on their methodological preference.

EDHI 704 Issues and Institutions in International Educational Development (3 credits)
Credit only granted for: EDHI704, EDPL704, or EDPS704. Formerly: EDPL704.
Examines the role of educational institutions in international development and the issues involved in educational planning and policymaking at the local, national and international levels.

EDHI 705 International Educational Change (3 credits)
Credit only granted for: EDHI705, EDPL705, or EDPS705. Formerly: EDPL705.
Exploration and analysis of major trends in education in several parts of the world, with attention directed to educational change as the outcome of deliberate efforts by nations and international organizations as well as those which occur without central planning or direction.

EDHI 706 Education in Developing Countries (3 credits)
Credit only granted for: EDHI706, EDPL706, or EDPS706. Formerly: EDPL706.
Examination of the development of modern educational systems in Africa, Asia and Latin America out of the colonial and traditional past into the independent present and future. Focus is on changing philosophies and persistent educational problems in these societies.

EDHI 707 Education Planning in Developing Countries (3 credits)
Recommended: EDHI706. Credit only granted for: EDHI707, EDPL707, or EDPS707. Formerly: EDPL707.
An examination of the international and social context as well as methods and problems of education development planning in developing countries, focusing on the multiple roles of the development consultant and case studies.

EDHI 710 Globalization and Education (3 credits)
Recommended: EDHI605. Credit only granted for: EDHI710 or EDHI788J. Formerly: EDHI788J.
Multiple education policies, practices, and innovations linked to economic, technological, and cultural dimensions of globalization are affecting education systems. The consequences of such forces on educational equality, equity, and quality, noting similarities and differences between industrialized and developing countries will be explored.

EDHI 713 Non-Formal Education (3 credits)
Recommended: EDHI605. Credit only granted for: EDHI707, EDHI713 or EDHI788N. Formerly: EDHI788N.
An examination of forms of education outside the formal education system--known generally as nonformal (NFE) education and including popular education--to identify how these forms can assist marginalized populations in both Third World and industrialized countries to improve their quality of life and undertake collective action for social advancement.

EDHI 725 Education in East Asia (3 credits)
Credit only granted for: EDHI725, EDPL725, or EDPS725. Formerly: EDPL725.
The course traces the cultural and intellectual history of education in East Asia, and examine features and important issues in East Asian education systems. School reform and social changes are studied.

EDHI 740 Managing Educational Organizations in a Diverse Society (3-6 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI740, EDPL740, or EDPS740. Formerly: EDPL740.
Contemporary social and cultural influences that impact on the management of educational organizations in a diverse society. The effects on schools of changes in the economy, family structure, demographics and technology.

EDHI 741 Policy Studies in Educational Administration (3 credits)
Credit only granted for: EDHI741, EDPL741, or EDPS741. Formerly: EDPL741.
Empahsis on understanding the role of participants/procedures used in the development of public policies that affect educational organizations; development of technical skills related to the policy process.

EDHI 742 Leadership Law and Ethics (3 credits)
Credit only granted for: EDHI742, EDPL742, or EDPS742. Formerly: EDPL742.
Constitutional principals of American society as they effect the work and shape the social context of educational leadership. Issues considered include religious liberty, freedom of expression and association, equality and due process, and the rights of special needs populations. Consideration of these topics both as matters of law through the analysis of relevant court cases and statutes and as ethical issues through the discussion of vignettes and cases.

EDHI 743 Leadership Theory (3 credits)
Prerequisite: EDHI642. Credit only granted for: EDHI743, EDPL743, or EDPS743. Formerly: EDPL743.
Critical analysis of contemporary leadership theoretical constructs. Consideration of implications for organizational improvement.

EDHI 744 Organizational Theory in Research and Practice (3 credits)
Credit only granted for: EDHI744, EDPL744, or EDPS744. Formerly: EDPL744.
This course provides an overview of the study of organizations for graduate students interested in education and social policy. Class lectures focus on contrasting theories and critiquing application of theories to social policy problems with an emphasis on education. Case materials focus on a variety of organizational areas including: schools, hospitals, non-profit community based organizations, the arts, elected bodies, higher education and private business.

EDHI 746 Restructuring Schools (3 credits)
Prerequisite: EDHI642. Restriction:

Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI746, EDPL746, or EDPS746. Formerly: EDPL746.
Issues related to restructuring. Roles of faculty and administrators are emphasized.

EDHI 747 Advanced Seminar on Instructional Improvement (3-6 credits)
Prerequisite: EDHI647. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI747, EDPL747, or EDPS747. Formerly: EDPL747.
Current issues, trends, and problems in the areas of instructional improvement and the supervisory responsibilities of school-based administrators.

EDHI 750 International Higher Education (3 credits)
Credit only granted for: EDHI750, EDPL750, or EDPS750. Formerly: EDPL750.
Comparison of higher education systems in several countries, and of the problems and issues in higher education faced by these countries.

EDHI 752 State Systems of Higher Education (3 credits)
Credit only granted for: EDHI752, EDPL752, or EDPS752. Formerly: EDPL752.
Creation, operation, alteration and evaluation of state systems of higher education. Campus autonomy versus public accountability. Analysis of topics such as state planning, budget and program review, and administration of student aid and federal programs.

EDHI 754 Higher Education Finance (3 credits)
Credit only granted for: EDHI754, EDPL754, or EDPS754. Formerly: EDPL754.
Economic perspectives on higher education. Ways of financing higher education and current finance issues. Higher education budget concepts and processes.

EDHI 755 Federal Policies in Post-Secondary Education (3 credits)
Credit only granted for: EDHI755, EDPL755, or EDPS755. Formerly: EDPL755.
Evolution of the federal role, its current scope and funding. Policy issues associated with federal student aid programs, research grants and social equity regulations.

EDHI 759 Seminar in Adult and Continuing Education (3 credits)
Formerly: EDPL759.
Current issues and problems in adult and continuing education and lifelong learning in America.

EDHI 760 The Human Dimension in Administration (3-6 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI760, EDPL760, or EDPS760. Formerly: EDPL760.
Theory, research findings, and laboratory experiences in human skills in organizations.

EDHI 767 Seminar on School District Leadership (3-6 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI767, EDPL767, or EDPS767. Formerly: EDPL767.
Examination of theory and research related to school district leadership. Focus on integration of organizational, political, community, instructional and ethical aspects of educational leadership.

EDHI 788 Special Topics in Education Policy and Administration (1-3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Repeatable to 6 credits. Formerly: EDPL788.
Special and intensive treatment of current topics and issues in education policy and administration.

EDHI 789 Doctoral Practicum in Administration and Supervision (1-3 credits)
Repeatable to 3 credits if content differs. Formerly: EDPL789.
Experiential activities designed to enhance student skills. Based on Individual Professional Development Plan for each student.

EDHI 798 Special Problems in Education (1-6 credits)
Formerly: EDPL798.
Master's, AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number.

EDHI 799 Master's Thesis Research (1-6 credits)
Formerly: EDPL799.

EDHI 805 Seminar in Comparative Education (3 credits)
Credit only granted for: EDHI805, EDPL805, or EDPS805. Formerly: EDPL805.
Analysis of educational issues on a worldwide basis with opportunities to focus on a particular country on an individual basis. Analysis of qualitative research methods as used in cross-cultural and comparative education studies.

EDHI 839 Seminar in Teacher Education (3-6 credits)
Repeatable to 6 credits. Formerly: EDPL839.
A problem seminar in teacher education.

EDHI 845 Advanced Planning in Education (3 credits)
Prerequisite: EDHI641. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI845, EDPL845, or EDPS845. Formerly: EDPL845.
Development of conceptual skills and understanding of approaches to planning in educational organizations. Completion of a strategic comprehensive planning exercise is required.

EDHI 853 Leadership in Higher Education (3 credits)
Prerequisite: EDHI653. Credit only granted for: EDHI853, EDPL853, or EDPS853. Formerly: EDPL853.
Theories of organizational leadership applied to institutions of higher education.

EDHI 855 Lifelong Learning Policy (3 credits)
Credit only granted for: EDHI855, EDPL855, or EDPS855. Formerly: EDPL855.
Policies and programs for training and continued learning in business and industry, government agencies, unions, professional societies, and nonprofit organizations.

EDHI 862 Seminar: Theoretical Basis of Administrative Behavior (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDHI862, EDPL862, or EDPS862. Formerly: EDPL862.
Study of administrative behavior in educational institutions. Development of a research design for the study of administrative behavior in one educational institution.

EDHI 888 Apprenticeship in Education (1-8 credits)
Restriction: Permission of EDUC-

Counseling, Higher Education and Special Education department.
Formerly: EDPL888.
Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDHI 889 Internship in Education (3-8 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Formerly: EDPL889.
Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDHI 895 Research Critique Seminar (3 credits)
Credit only granted for: EDHI895, EDPL895, or EDPS895. Formerly: EDPL895.
Critiques of research designs in preparation for the doctoral dissertation.

EDHI 898 Pre-Candidacy Research (1-8 credits)
Formerly: EDPL898.

EDHI 899 Doctoral Dissertation Research (1-8 credits)
Formerly: EDPL899.
Registration required to the extent of 6-9 hours for an Ed.D. Project and 12-18 hours for a Ph.D. Dissertation.

Measurement, Statistics, and Evaluation (EDMS)

EDMS 410 Classroom Assessment (3 credits)
Restriction: Junior standing or higher.
Developing and using classroom assessments, including tests, performance assessments, rating scales, portfolios, observations and oral interactions; basic psychometric statistics; standard setting; grading; communicating assessment information; testing ethics; locating and evaluating measures; program evaluation and classroom research; assessments used for educational policy decisions.

EDMS 451 Introduction to Educational Statistics (3 credits)
Restriction: Sophomore standing or higher. Credit only granted for: BIOM301, BMGT230, CCJS200, ECON230, ECON321, EDMS451, GEOG306, GEOL351, GVPT422, PSYC200 or SOCY201.
Introduction to statistical reasoning; location and dispersion measures; computer applications; regression and correlation; formation of hypotheses tests; t-test; one-way analysis of variance; analysis of contingency tables.

EDMS 489 Field Experiences in Measurement and Statistics (1-4 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 4 credits.
Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDMS 498 Special Problems in Measurement and Statistics (1-3 credits)
Prerequisite: Available only to education majors who have formal plans for individual study of approved problems. Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 6 credits.
Available only to education majors who have formal plans for individual study of approved problems.

EDMS 610 Classroom Assessment and Evaluation (3 credits)
Develop the understandings and skills needed to validly, reliably, and accurately assess student learning and to provide focused leadership in the area of classroom assessment.

EDMS 622 Theory and Practice of Standardized Testing (3 credits)
Prerequisite: EDMS451; or EDMS645.
Principles of interpretation and evaluation of aptitude, achievement, and personal-social instruments; theory of reliability and validity; prediction and classification; norm- and criterion-referenced testing concepts.

EDMS 623 Applied Measurement: Issues and Practices (3 credits)
Prerequisite: EDMS410. And EDMS645; or students who have taken courses with comparable content may contact the department.
Measurement theory and its application at an intermediate level; test development, validation and interpretation; issues and recent developments in measurement.

EDMS 626 Instrumentation (3 credits)
Prerequisite: EDMS623.
Theory, development, and applications of various affective, cognitive, or behavioral measurement instruments and procedures, including questionnaire and test items, observational protocols, and cutting-edge innovative game and scenario-based assessments.

EDMS 645 Quantitative Research Methods I (3 credits)
Research design and statistical applications in educational research: data representation; descriptive statistics; estimation and hypothesis testing. Application of statistical computer packages is emphasized.

EDMS 646 General Linear Models I (3 credits)
Prerequisite: EDMS645; or an equivalent introductory statistics course.
A first post-introductory inferential statistics course, with emphasis on analysis of variance procedures and designs from within the general linear modeling framework. Assignments include student analysis of education and related data; application of statistical software packages is emphasized.

EDMS 647 Causal Inference and Evaluation Methods (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in EDMS651.
Counterfactual (potential outcomes) framework for causal inference, design/analysis strategies for confounder control, and specific best-practice applications to the evaluation of programs.

EDMS 651 General Linear Models II (3 credits)
Prerequisite: EDMS646; or students who have taken courses with comparable content may contact the department.
Multiple regression and correlation analysis; trend analysis; hierarchical and stepwise procedures; logistic regression; software for regression analysis.

EDMS 655 Introduction to Multilevel Modeling (3 credits)
Prerequisite: EDMS651; or students who have taken courses with comparable content may contact the department.
Introduction to multilevel models and methodology as strategies for modeling change and organizational effects.

EDMS 657 Exploratory Latent and Composite Variable Methods (3 credits)
Prerequisite: EDMS651.
Development of models for exploratory

factor analysis and their practical applications. Additional topics will draw from latent class analysis, cluster analysis, mixture models, canonical correlation, multidimensional scaling, and configural frequency analysis.

EDMS 665 Data Analysis and Statistical Consulting (3 credits)

Prerequisite: EDMS651; or students who have taken courses with comparable content may contact the department.

Advanced data analysis procedures applied to real-world clients' problems arising in a wide variety of substantive research settings within and beyond education.

EDMS 722 Structural Modeling (3 credits)

Prerequisite: EDMS657.

Statistical theory and methods of estimation used in structural modeling; computer program applications; multisample models; mean structture models; structural models with multilevel data (e.g., sampling weights, growth models, multilevel latent variable models).

EDMS 724 Modern Measurement Theory (3 credits)

Prerequisite: EDMS623 and EDMS651.

Theoretical formulations of measurement from a latent trait theory perspective.

EDMS 738 Seminar in Special Problems in Measurement (1-3 credits)

Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 3 credits.

An opportunity for students with special interests to focus in depth on contemporary topics in measurement. Topics to be announced, but will typically be related to applied and theoretical measurement.

EDMS 747 Design of Program Evaluations (3 credits)

Prerequisite: EDMS626, EDMS651, and EDMS647. Or permission of instructor; and permission of EDUC-Human Development and Quantitative Methodology department.

Analysis of measurement and design problems in program evaluations.

EDMS 769 Special Topics in Applied Statistics in Education (1-4 credits)

Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.

Designed primarily for students majoring or minoring in measurement, statistics or evaluation.

EDMS 771 Multivariate Data Analysis (3 credits)

Prerequisite: EDMS651.

Principal components, canonical correlation, discriminant functions, multivariate analysis of variance/covariance and other multivariate techniques.

EDMS 779 Seminar in Applied Statistics (1-3 credits)

Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. And must be in Measurement, Statistics and Evaluation (Master's) program; or must be in Measurement, Statistics and Evaluation (Doctoral) program. Repeatable to 3 credits if content differs.

Enrollment restricted to students with a major or minor in measurement, statistics or evaluation. Seminar topics will be chosen by individual student interest.

EDMS 787 Bayesian Inference and Analysis (3 credits)

Prerequisite: EDMS651. Credit only granted for: EDMS769B or EDMS787. Formerly: EDMS769B.

Models and model fitting methods commonly used in Bayesian Inference, such as Markov Chain Monte Carlo methods (e.g., Gibbs, Metropolis Sampling), with applications within and beyond the social and behavioral sciences. Analytical and philosophical differences between Frequentist and Bayesian statistics will also be highlighted.

EDMS 798 Special Problems in Education (1-6 credits)

Restriction: Must be in Measurement, Statistics and Evaluation (Master's) program; or must be in Measurement, Statistics and Evaluation (Doctoral) program.

Master's, EDMS majors, or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number.

EDMS 799 Master's Thesis Research (1-6 credits)

Restriction: Must be in a major within EDUC-Human Development and Quantitative Methodology department.

Registration required to the extent of 6 credits.

EDMS 879 Doctoral Seminar (1-3 credits)

Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.

Seminar that supports analysis of doctoral projects and theses, and of other on-going research projects.

EDMS 889 Internship in Measurement and Statistics (3-12 credits)

Prerequisite: Open only to students advanced to candidacy for doctoral degree. Restriction: Permission of EDUC-Human Development and Quantitative Methodology department.

Provides internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDMS 898 Pre-Candidacy Research (1-8 credits)

EDMS 899 Doctoral Dissertation Research (1-8 credits)

Registration required to the extent of 12 credits.

Education Policy Studies (EDPS)

EDPS 401 Educational Policy, and Social Change (3 credits)

Credit only granted for: EDPL401 or EDPS401. Formerly: EDPL401.

An examination of education policy in relation to the social environment and change. Contemporary education and social issues are examined, including technology as a complex force which influences social change. This is a Social Foundations course.

EDPS 488 Special Topics in Education Policy and Administration (1-3 credits)

Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Formerly: EDPL488.

Special and intensive treatment of current topics and issues in education policy and administration.

EDPS 489 Field Experiences in Education (1-4 credits)

Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Formerly: EDPL489.

Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDPS 498 Special Problems in Education (1-3 credits)

Restriction: Permission of EDUC-

Teaching, Learning, Policy and Leadership department. Formerly: EDPL498.
Available only to students who have definite plans for individual study of approved problems.

EDPS 499 Workshops, Clinics, and Institutes (1-6 credits)

Formerly: EDPL499.
The following type of educational enterprise may be scheduled under this course heading: Workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals, and supervisors.

EDPS 601 Contemporary Social Issues in Education (3 credits)

Credit only granted for: EDHI601, EDPL601, or EDPS601. Formerly: EDPL601.
Theoretical and practical consideration of vital social issues currently affecting education.

EDPS 610 History of Western Education (3 credits)

Credit only granted for: EDHI610, EDPL610, or EDPS610. Formerly: EDPL610.
Educational institutions through the ancient, medieval and early modern periods in western civilization, as seen against a background of socio-economic development.

EDPS 611 History of Education in the United States (3 credits)

Credit only granted for: EDHI611, EDPL611, or EDPS611. Formerly: EDPL611.
A study of the origins and development of education in the United States, emphasizing the variety of interpretive and methodological concerns that define the field.

EDPS 612 Philosophy of Education (3 credits)

Credit only granted for: EDHI612, EDPL612, or EDPS612. Formerly: EDPL612.
A study of the great educational philosophers and systems of thought affecting the development of modern education, with particular emphasis on recent scholarship on philosophical problems in education.

EDPS 613 Educational Sociology (3 credits)

Credit only granted for: EDHI613, EDPL613, or EDPS613. Formerly: EDPL613.
The sociological study of education as an evolving set of methods and procedures, and body of knowledge. Focuses on several major theoretical perspectives used by sociologists studying education.

EDPS 614 Politics of Education (3 credits)

Credit only granted for: EDHI614, EDPL614, or EDPS614. Formerly: EDPL614.
Educational institutions as political entities. Focuses on conceptual perspectives for examining political dynamics in governmental and organizational contexts. Provides opportunities to carry out original case studies of policy making processes at various levels of the education policy system.

EDPS 615 Economics of Education (3 credits)

Credit only granted for: EDHI615, EDPL615, or EDPS625. Formerly: EDPL615.
An introduction to the application of economic principles to the study of education policy. The course content revolves around issues of efficiency, equity, and freedom of choice. Specific attention is devoted to school finance litigation and reform, practices for raising and allocating resources, and education productivity issues.

EDPS 620 Education Policy Analysis (3 credits)

Credit only granted for: EDHI620, EDPL620, or EDPS620. Formerly: EDPL620.
Policy making in education from planning to evaluation with emphasis on the identification of policy problems and the resources available to analysts through multi-disciplinary approaches. An introductory experience with education policy analysis.

EDPS 621 Policy and Program Evaluation for Organizational Improvement (3 credits)

Credit only granted for: EDHI621, EDPL621, or EDPS621. Formerly: EDPL621.
Alternative approaches to the evaluation of education policies programs. Provides opportunities to design and conduct an evaluation. Addresses the various uses of evaluative information including its role in organizational decision making and improvement.

EDPS 622 Education Policy, Values, and Social Change (3 credits)

Credit only granted for: EDHI622, EDPL622, or EDPS622. Formerly: EDPL622.
Examination of relationships among educational policy, values, and social change. Roles of educational organizations and institutional change in such social issues as equity and cultural diversity.

EDPS 623 Education Policy and Theories of Change (3 credits)

Credit only granted for: EDHI623, EDPL623, or EDPS623. Formerly: EDPL623.
The work of change theorists in history, economics, political science, philosophy, sociology and anthropology as it impinges upon education policy.

EDPS 624 Culture in Education Policy and Practice (3 credits)

Credit only granted for: EDHI624, EDPL624, or EDPS624. Formerly: EDPL624.
Focuses on the exploration of culture as it shapes and is reflected in education purposes, policies and practices. Participants will have opportunities to engage in cultural analysis, to analyze unfamiliar cultural habits and associations, to develop a focus for intensive comparative cultural study in education, and to integrate a field work component into their studies.

EDPS 625 Federal Education Policy (3 credits)

Credit only granted for: EDHI625, EDPL625, or EDPS625. Formerly: EDPL625.
Federal involvement in education in the United States from 1780 to the present, emphasizing the effects of legislation, court decisions, agencies, and presidential initiatives on the distribution of education opportunities.

EDPS 626 Educatin Policy and the Young (3 credits)

Credit only granted for: EDHI626, EDPL626, or EDPS626. Formerly: EDPL626.
The systematic exploration of education policy as it has organized, reflected and influenced the lives of children, youth, and families, with particular emphasis on American policies and systems.

EDPS 634 The School Curriculum (3 credits)

Credit only granted for: EDHI634, EDPL634, or EDPS634. Formerly: EDPL634.
A foundations course embracing the curriculum as a whole from early childhood through adolescence, including a review of historical developments, an analysis of conditions affecting curriculum change, an examination of issues in curriculum making, and a consideration of current trends in curriculum design.

EDPS 635 Principles of Curriculum Development (3 credits)
Credit only granted for: EDHI635, EDPL635, or EDPS635. Formerly: EDPL635.
Curriculum planning, improvement, and evaluation in the schools; principles for the selection and organization of the content and learning experiences; ways of working in classroom and school on curriculum improvement.

EDPS 636 Communication and the School Curriculum (3 credits)
Credit only granted for: EDHI636, EDPL636, or EDPS636. Formerly: EDPL636.
Curriculum development based on communication as the major vehicle for describing the learner's interactions with persons, knowledge, and materials in the classroom and school environment.

EDPS 663 Policy Formulation in Education (3-6 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDHI663, EDPL663, or EDPS663. Formerly: EDPL663.
Various levels of school governance. Analysis of policy formation, administration and evaluation issues.

EDPS 676 School Finance and Business Administration (3 credits)
Credit only granted for: EDHI676, EDPL676, or EDPS676. Formerly: EDPL676.
Introduction to principles and practices in the administration of the public school finance activity. Sources of tax revenue, the budget, and the function of finance in the educational program are considered.

EDPS 679 Master's Seminar (3 credits)
Formerly: EDPL679.
Directed study for master's degree students writing seminar papers.

EDPS 689 Practicum In Educational Administration and Supervision (1-3 credits)
Repeatable to 3 credits if content differs. Formerly: EDPL689.
Promotes skill development in managerial, leadership and supervisory areas. Practicum is based on results of diagnostic instruments and an individual professional development plan.

EDPS 690 Research in Education Policy, Planning and Administration (3 credits)
Credit only granted for: EDHI690, EDPL690, or EDPS690. Formerly: EDPL690.
Introduction to research methods and designs used in studies of education policy, planning, and administration.

EDPS 703 Quantitative Applicaltions for Education Policy Analysis (3 credits)
Prerequisite: EDMS645; or students who have taken courses with comparable content may contact the department. Recommended: EDMS646; or EDMS651. Or EDMS646; and EDMS651. Credit only granted for: EDHI703, EDPL703, EDPL788U, or EDPS703. Formerly: EDPL703.
Students use quantitative applications and secondary datasets to investigate social problems and education policies. Emphasis on the use of quasi-experimental designs and regression techniques to frame education issues, analyze, and recommend policies.

EDPS 711 Oral History and Education (3 credits)
Restriction: Permission of instructor. Credit only granted for: EDHI711, EDPL711, or EDPS711. Formerly: EDPL711.
Introduction to the art, science, and craft of oral history as reflected in education purposes, policies and practices.

EDPS 712 Analysis of Educational Concepts (3 credits)
Credit only granted for: EDHI712, EDPL712, or EDPS712. Formerly: EDPL712.
Analyses of selected concepts used in thinking about education.

EDPS 730 Seminar on Case Study Methods (3 credits)
Prerequisite: EDPS690; or students who have taken courses with comparable content may contact the department. Credit only granted for: EDHI730, EDPL730, EDPL788E, or EDPS730. Formerly: EDPL730.
Conceived as both an analysis of case study methods and a laboroatory for applying course content to research topics or projects of interest to students, it addresses a range of conceptual, methodological, ethical, political, and logistical issues embedded in efforts to conduct thoughtful, "disciplined" case study research. Since this focuses on case study research, it may be particularly helpful to students who are exploring various approaches to research or who are contemplating using case study methods in their theises and/or dissertations.

EDPS 731 Transcultural Education Policy and Practice (3 credits)
Prerequisite: EDPS624; or students who have taken courses with comparable content may contact the department. Credit only granted for: EDHI731, EDPL731, or EDPS731. Formerly: EDPL731.

EDPS 732 History of Curriculum Theory and Development (3 credits)
Prerequisite: EDPS635. Restriction: Permission of EDUC-Education Policy and Leadership department. Credit only granted for: EDHI732, EDPL732, or EDPS732. Formerly: EDPL732.
The writings of major educators in curriculum. Conceptual and formal similarities and differences between current curriculum projects and historical antecedents. Survey of curriculum materials for classroom use in their relationship to the curriculum theory of their time.

EDPS 735 Phenomenological Inquiry I (3 credits)
Credit only granted for: EDHI735, EDPL735, or EDPS735. Formerly: EDPL735.
Philosophic grounding for phenomenological inquiry at a beginning level. Guided writing practice in doing phenomenological inquiry is provided on a selected lived experience phenomenon.

EDPS 736 Phenomenological Inquiry II (3 credits)
Prerequisite: EDPS735. Credit only granted for: EDHI736, EDPL736, or EDPS736. Formerly: EDPL736.
This advanced course in phenomenological methodology provides an expanded philosophic and methodological grounding for conducting phenomenological research. Attention is given to the development of phenomenological projects through the process of phenomenological writing. It is especially relevant for persons interested in the study of lived meanings in the domains of education, psychology, counseling, the health sciences and related academic and professional fields.

EDPS 738 Scholarly Thought and Contemporary Curriculum (1-3 credits)
Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Repeatable to 6 credits. Formerly: EDPL738.
Current curricular trends, issues, theory, and research in the light of past curricular and social thought.

EDPS 751 Law, Equity, and Diversity in Education (3 credits)
Prerequisite: EDHI651 or EDHI671; or permission of instructor. Credit only

granted for: EDHI751, EDPL751, or EDPS751. Formerly: EDPL751.
An examination of 'dilemmas of difference' on selected issues that arise at the intersection of law and education policy. Dilemmas and value conflicts imbedded in modern federal and state case law dealing with race, gender, sexual orientation, religion and disability.

EDPS 756 Curriculum in Higher Education (3 credits)
Credit only granted for: EDHI756, EDPL756, or EDPS756. Formerly: EDPL756.
Conditions affecting curriculum change in higher education, including critical analysis of various bases for the college curriculum in the context of college and university life.

EDPS 757 College Teaching (3 credits)
Credit only granted for: EDHI757, EDPL757, or EDPS757. Formerly: EDPL757.
Critical review of literature on teaching in higher education from conceptual and practical viewpoints. Designed for current and prospective adult educators. Focused on research and improvement of instruction.

EDPS 766 Educational Indicator and Productivity (3 credits)
Prerequisite: EDHI646 or EDHI647. Restriction: Permission of EDUC-Human Development and Quantitative Methodology department. Credit only granted for: EDHI766, EDPL766, or EDPS766. Formerly: EDPL766.
Examination of issues in educational productivity. Focuses on educational indicators and productivity research. Explores ways to improve educational effectiveness, efficiency and equity.

EDPS 788 Special Topics in Education Policy and Administration (1-3 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Repeatable to 6 credits. Formerly: EDPL788.
Special and intensive treatment of current topics and issues in education policy and administration.

EDPS 789 Doctoral Practicum in Administration and Supervision (1-3 credits)
Repeatable to 3 credits if content differs. Formerly: EDPL789.
Experiential activities designed to enhance student skills. Based on Individual Professional Development Plan for each student.

EDPS 798 Special Problems in Education (1-6 credits)
Formerly: EDPL798.
Master's, AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number.

EDPS 799 Master's Thesis Research (1-6 credits)
Formerly: EDPL799.

EDPS 811 Seminar in History of Education (3 credits)
Credit only granted for: EDHI811, EDPL811, or EDPS811. Formerly: EDPL811.
Examination of current developments and continuing controversies in the field of history of education. The analysis of the various ways in which history of education is approached methodologically and interpretatively.

EDPS 812 Seminar in Philosophy of Education (3 credits)
Credit only granted for: EDHI812, EDPL812, or EDPS812. Formerly: EDPL812.
Examination of current developments and continuing controversies in the field of philosophy of education. The function of educational philosophy, methodological approaches, and current research trends.

EDPS 813 Seminar in Educational Sociology (3 credits)
Credit only granted for: EDHI813, EDPL813, or EDPS813. Formerly: EDPL813.
Sociological analysis of educational processes and institutions; emphasis on the social effects of formal organizations.

EDPS 837 Race, Class, and Social Justice: A Policy Seminar in Curriculum Theory and Development (3 credits)
Prerequisite: EDPS635. Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Credit only granted for: EDHI837, EDPL837, or EDPS837. Formerly: EDPL837.
An advanced seminar focusing upon critical analyses of the themes, concepts, and language relevant to Curriculum Theory, Policy, and Research. Focus on education policy issues relating to race, class, and social justice with special reference to patterns of economic and cultural distribution, their impact upon persons at society's margins and on specific curricular responses to injustice.

EDPS 888 Apprenticeship in Education (1-8 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Formerly: EDPL888.
Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDPS 889 Internship in Education (3-8 credits)
Restriction: Permission of EDUC-Teaching, Learning, Policy and Leadership department. Formerly: EDPL889.
Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDPS 898 Pre-Candidacy Research (1-8 credits)
Formerly: EDPL898.

EDPS 899 Doctoral Dissertation Research (1-8 credits)
Formerly: EDPL899.
Registration required to the extent of 6-9 hours for an Ed.D. Project and 12-18 hours for a Ph.D. Dissertation.

Education, Special (EDSP)

EDSP 400 Functional Assessment and Instruction in Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP602. Credit only granted for: EDSP400 or EDSP602.
Functional assessment procedures and instructional methods for students with severe disabilities from birth to adulthood.

EDSP 402 Field Placement: Severe Disabilities I (2-5 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Practicum experience in settings serving students with severe disabilities.

EDSP 403 Instruction of Students with Physical Disabilities (3 credits)
Also offered as: EDSP603. Credit only granted for: EDSP403 or EDSP603.
Assessment, curriculum, and instruction for students with physical disabilities. Focus on etiology, environmental and learning adaptations, and assistive technology.

EDSP 404 Education of Students with Autism Spectrum Disorders (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP604. Credit only granted for: EDSP404 or EDSP604.
Characteristics, needs, assessment, and educational methods for students with autism spectrum disorders.

EDSP 405 Field Placement: Severe Disabilities II (2-5 credits)
Prerequisite: Must have completed or be concurrently enrolled in EDSP410 and EDSP403; and EDSP402. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Practicum experience in settings serving severely disabled individuals. Field placement for two to five half-days per week.

EDSP 410 Functional Reading and Community Based Instruction (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP614. Credit only granted for: EDSP410 or EDSP614.
Functional assessment, curriculum, and instruction related to reading and community functioning skills for students with severe disabilities.

EDSP 413 Behavior and Classroom Management in Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP613. Credit only granted for: EDSP413, or EDSP613.
Use of applied behavior analysis for assessment of behavior and learning environments. Design of behavior and classroom management of students in special education.

EDSP 415 Assessment in Special Education (3 credits)
Recommended: STAT100; or SOCY201. Restriction: Must be in Special Education program. Also offered as: EDSP615. Credit only granted for: EDSP415, or EDSP615.
Knowledge and skills for understanding assessment process and interpretation of assessment data. Emphasis on psychometric aspects of assessment related to screening, eligibility, and program planning.

EDSP 416 Reading and Writing Instruction in Special Education I (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP616. Credit only granted for: EDSP416 or EDSP616.
Assessment and instruction of reading and writing skills for students in special education.

EDSP 417 Reading Diagnosis and Assessment (3 credits)
Prerequisite: EDSP423, EDHD431, and EDSP315; and track 1: Must have completed EDSP430 and EDSP433; OR Track 2: Must have completed EDHD415 and EDHD424. Corequisite: EDHD322, EDHD323, EDSP321, EDHD441, EDHD442, EDHD443, and EDHD444.
Reading Diagnosis and Assessment prepares teacher candidates to assess children in general and special early childhood educations settings in the areas of reading and writing in order to plan for instruction. The course will focus on diagnostic, screening, progress monitoring, and outcome assessments in early and beginning literacy. The course is designed to provide participants with the knowledge and skills necessary to collect and use a wide range of assessment data in general education and special education settings. Includes field experience.

EDSP 420 Child Development, Birth to Three Years (3 credits)
Prerequisite: EDHD210 and EDHD220. Corequisite: EDHD425 and EDHD314. Restriction: Must be in Special Education program.
Child development theory and research, as well as knowledge about typical and atypical development of children from birth to three years of age. The course emphasizes learning for children with and without disabilities, and for children who are at risk due to poverty and other environmental factors. The course will introduce how children develop and the challenges they face within the domains of physical, cognitive, language, social, and emotional development, with particular attention paid to the impact of risk factors on development. Students will become familiar with delays and differences in development that may occur as the result of disability. Finally, students will learn the effects of cultural and linguistic differences on growth and development. Information about theory and research in child development for children with and without disabilities will be enhanced through a series of observational experiences, which will build upon concepts addressed during class. Includes field experiences.

EDSP 421 Field Placement in Special Education: Early Childhood I (2-4 credits)
Restriction: Must be in Special Education program; or must be in one of the following programs (Special Education (Doctoral); Special Education (Master's)).
Field experience I in early childhood special education.

EDSP 422 Curriculum and Instruction: Early Childhood Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP627. Credit only granted for: EDSP422 or EDSP627.
Curriculum and instruction for young children with mild and moderate disabilities, preschool through primary grades.

EDSP 423 Assessment in Early Childhood Special Education (3 credits)
Restriction: Must be in Special Education program. Credit only granted for: EDSP423 or EDSP624.
Assessment procedures for infants and young children with disabilities, birth through grade 3.

EDSP 424 Field Placement in Special Education: Early Childhood II (2-4 credits)
Restriction: Must be in Special Education program.
Field experience in early childhood special education.

EDSP 430 Early Intervention: Early Childhood Special Education (3 credits)
Restriction: Must be in Special Education program. Credit only granted for: EDSP430 or EDSP631.
Intervention with infants and young children with disabilities. Focus on moderate and severe disabilities.

EDSP 433 Families and Culture in Early Intervention (Birth-5) (3 credits)
Prerequisite: EDHD314 and EDHD425; and (EDHD419 or EDSP420). Corequisite: EDSP430, EDSP315, and EDHD431.
Provides students with the skills and information they need to work effectively with families of young children (birth to age 5) who have or are at risk for disabilities in early childhood or early intervention programs. Students will review current local, state and federal policies establishing the rights of families of infants and young children with disabilities to participate in decision making for their child. We will discuss relevant theoretical and research literature as well as the cultural and contextual issues involved in working with families of very young children. Includes field experiences.

EDSP 434 Field Placement in Special Education: Secondary Middle I (2-4 credits)
Restriction: Must be in Special Education program.

Field experience in secondary middle special education.

EDSP 435 Field Placement in Special Education: Secondary Middle II (2-4 credits)
Restriction: Must be in Special Education program.
Field experience in secondary middle special education.

EDSP 443 Language and Literacy Acquisition in Children with Disabilities (3 credits)
Restriction: Must be in Special Education program. Additional information: This course is the first of four reading courses required by the Maryland State Department of Education for teacher certification in Special Education.
Language and literacy acquisition and characteristics of typical and atypical language development in supporting students with reading and writing disabilities.

EDSP 450 Inclusive Practices in the Schools (3 credits)
Also offered as: EDSP606. Credit only granted for: EDSP450 or EDSP606.
Educational practices regarding inclusive education in the schools for students with and without disabilities.

EDSP 451 Curriculum and Instruction: Elementary/Middle Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP652. Credit only granted for: EDSP451 or EDSP652.
Methods for instruction of students with disabilities in the general education curriculum. Collaboration with other professionals is included.

EDSP 452 Field Placement in Special Education: Elementary I (2-4 credits)
Restriction: Must be in Special Education program.
Field experience in elementary special education.

EDSP 453 Methods and Models of Instruction: Elementary Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP653. Credit only granted for: EDSP453 or EDSP653.
Focus on models and methods of instruction responsive to the cognitive, linguistic, and cultural characteristics of elementary students in special education.

EDSP 454 Field Placement in Special Education: Elementary II (2-4 credits)
Restriction: Must be in Special Education program.
Field experience in elementary special education.

EDSP 455 Assessment in Elementary Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP654. Credit only granted for: EDSP455 or EDSP654.
Focus on selection, administration, and interpretation of assessment tools and results for designing instruction and evaluating progress of elementary students in special education.

EDSP 466 Issues and Models of Instruction: Middle/Secondary Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP664. Credit only granted for: EDSP466 or EDSP664.
Issues, legislation, and service models in middle/secondary special education. Emphasis on career and vocational education, self-determination, and transition.

EDSP 470 Introduction to Special Education (3 credits)
Restriction: Must not have completed EDSP210. Credit only granted for: EDSP210 or EDSP470.
Designed to give an understanding of the needs of all types of exceptional children.

EDSP 474 Assessment in Middle/Secondary Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP674. Credit only granted for: EDSP474 or EDSP674.
Cognitive, vocational, and social assessment for students with disabilities. Emphasis on interpretation of assessment results and case management practices.

EDSP 476 Communicating with Sign Language (3 credits)
Prerequisite: EDSP376. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Intermediate level receptive/expressive skills in American Sign Language. Aspects of the culture, history, and research perspectives of the deaf community.

EDSP 477 Curriculum, Assessment, and Instruction: Middle/Secondary Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP677. Credit only granted for: EDSP477 or EDSP677.
Methods and assessment practices for effective instruction in middle and secondary content areas for students in special education.

EDSP 481 Cultural Diversity and Disability (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP681. Credit only granted for: EDSP481, EDSP499C, EDSP678C, or EDSP681. Formerly: EDSP499C.
A study of diversity issues within special education, with attention to uses of race, culture, and disability as they pertain to teaching, learning, and social justice.

EDSP 482 Literacy Approaches for At-Risk Adolescents (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in EDHD426. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP682. Credit only granted for: EDSP482 or EDSP682.
Provides approaches to teaching reading in the content areas for secondary students with disabilities.

EDSP 484 Reading and Writing Instruction in Special Education II (3 credits)
Prerequisite: EDSP416. Restriction: Must be in Special Education program. Also offered as: EDSP684. Credit only granted for: EDSP484 or EDSP684.
Focus on the development of reading and writing programs for students in special education. Builds on foundations established in EDSP416.

EDSP 485 Assessment and Instruction in Mathematics in Special Education (3 credits)
Restriction: Must be in Special Education program; or must be in one of the following programs (Special Education (Doctoral); Special Education (Master's)). Also offered as: EDSP683. Credit only granted for: EDSP485 or EDSP683.
Instructional methods and assessment in mathematics in special education.

EDSP 486 Promoting Prosocial Behavior in Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP686. Credit only granted for: EDSP486 or EDSP686.
Focus on social development among students with and without disabilities, the relationship between pedagogy and

student behavior, and classroom, school, and community approaches for developing prosocial behavior.

EDSP 487 Family Partnerships in Special Education (3 credits)
Restriction: Must be in Special Education program. Also offered as: EDSP687. Credit only granted for: EDSP487 or EDSP687.
Strategies for communicating and working with families of students with disabilities.

EDSP 488 Selected Topics in Teacher Education (1-3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department; or must be in a major in EDUC-College of Education. Repeatable to 6 credits if content differs.

EDSP 489 Field Experiences in Special Education (1-4 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDSP 490 Teacher Candidate Research Seminar in Special Education (3 credits)
Restriction: Must be in Special Education program.
Study of current issues and research concerning the education of students in special education.

EDSP 491 Characteristics of Learning Disabled Students (3 credits)
Prerequisite: EDSP470. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Diagnosis, etiology, physical, social, and emotional characteristics of learning disabled students.

EDSP 494 Internship: Early Childhood Special Education (6-12 credits)
Restriction: Must be in Special Education program.
Student teaching, full-time for twelve weeks, with infants or preschool children with disabilities.

EDSP 495 Internship: Elementary Special Education (6-12 credits)
Restriction: Must be in Special Education program; or must be in one of the following programs (Special Education (Doctoral); Special Education (Master's)).
Student teaching, full-time for twelve weeks, with elementary age children with disabilities.

EDSP 496 Internship: Middle/Secondary Special Education (6-12 credits)
Restriction: Must be in Special Education program.
Student teaching, full-time for twelve weeks, with middle or high school age students with disabilities.

EDSP 498 Special Problems in Special Education (1-6 credits)
Prerequisite: Available only to education majors who have definite plans for individual study of approved problems. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Available only to education majors who have definite plans for individual study of approved problems. Credit according to extent of work.

EDSP 499 Workshops, Clinics, and Institutes in Special Education (1-6 credits)
Repeatable to 6 credits if content differs.
The following type of educational enterprise may be scheduled under this course heading: workshops conducted by the special education department (or developed cooperatively with other departments, colleges and universities) and not otherwise covered in the present course listing. Laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDSP 600 Issues and Trends in Educating Individuals with Disabilities (3 credits)
Prerequisite: 9 credits in EDSP courses. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Examines research and practice relevant to the education of individuals with disabilities.

EDSP 601 Characteristics of Behaviorally Disordered Students (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Characteristics and theoretical perspectives related to students with behavioral disorders.

EDSP 602 Functional Assessment and Instruction in Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP400. Credit only granted for: EDSP400 or EDSP602.
Functional assessment procedures and instructional methods for students with severe disabilities from birth to adulthood.

EDSP 603 Instruction of Students with Physical Disabilities (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP403. Credit only granted for: EDSP403 or EDSP603.
Assessment, curriculum, and instruction for students with physical disabilities. Focus on etiology, environmental and learning adaptations, and assistive technology.

EDSP 604 Education of Students with Autism Spectrum Disorder (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP604, EDSP604. Credit only granted for: EDSP404 or EDSP604.
Characteristics, needs, assessment, and educational methods for students diagnosed as autistic or having a pervasive development disorder.

EDSP 605 The Exceptional Child and Society (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Relationship of the role and adjustment of the child with an exceptionality to societal characteristics.

EDSP 606 Advanced Study in Inclusive Practices in The Schools (3 credits)
Also offered as: EDSP450. Credit only granted for: EDSP450, EDSP606, or EDSP788P. Formerly: EDSP788P.
Educational practices regarding inclusive education in the schools for students with and without disabilities.

EDSP 607 School Violence and Disruption (3 credits)
An examination of school violence and disruption from multiple perspectives. Societal, community, and individual factors are examined. Prevention strategies, interagency collaboration, and intervention techniques are addressed.

EDSP 610 Special Education Leadership and Administration (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Research and application of programs fro children and youth with special needs for specail education administrative and supervisory personnel.

EDSP 612 Transition Methods and Disability Systems (3 credits)
Restriction: Permission of instructor.
Philosophical and historical foundatins of transition service delivery and current methods that comprise transition services for students with disabilities.

EDSP 613 Behavior and Classroom Management in Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program; or permission of instructor. Also offered as: EDSP413. Credit only granted for: EDSP413 or EDSP613.
Applied behavior analysis for assessment of behavior and learning environments. Behavior and classroom management strategies for students in special education.

EDSP 614 Advanced Topics in Functional Reading and Community Based Instruction (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP410. Credit only granted for: EDSP410 or EDSP614.
Functional assessment, curriculum, and instruction related to reading and community functioning skills for students with severe disabilities.

EDSP 615 Evaluation and Measurement of Exceptional Children and Youth (1-3 credits)
Prerequisite: EDSP600 and EDMS646; or permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP415. Credit only granted for: EDSP415 or EDSP615.
Deals with the understanding and interpretation of the results of psychological and educational tests applicable for use with exceptional children and youth.

EDSP 616 Reading and Writing Instruction in Special Education I (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP416. Credit only granted for: EDSP416 or EDSP616.
Assessment and instruction of reading and writing skills and strategies for students in special education.

EDSP 620 Educational Diagnosis and Planning For Learning Disabled Students (3 credits)
Prerequisite: EDSP491 and EDSP615. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Identification of learning characteristics of learning disabled students and planning of educational programs.

EDSP 621 Designing Intensive Interventions for Social and Academic Skill Development for Students with Persistent Needs (3 credits)
Prerequisite: EDSP600 and EDSP601; or permission of instructor. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Prerequisite: EDSP 600, EDSP 601 or consent of instructor. Strategies to teach social and academic skills to behaviorally disordered students.

EDSP 622 History, Research and Context in Behavioral and Learning Di sorders (3 credits)
Prerequisite: EDSP470. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Examination of theoretical, historical, and contextual influences affecting the study and treatment of persons with behavioral and learning disorders.

EDSP 623 Challenges and Issues in Behavioral and Learning Disorders (3 credits)
Prerequisite: EDSP470. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Development and outcomes for students with behavioral and learning disorders for inclusive schools, discipline, professional development and ethics.

EDSP 624 Assessment in Early Childhood Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP423. Credit only granted for: EDSP423 or EDSP624.
Assessment procedures for infants and young children with disabilities, birth through age eight.

EDSP 625 Seminar on Severely Handicapping Conditions (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Research and theories relevant to the education of severely handicapped individuals.

EDSP 626 Characteristics of Infants and Young Children: Early Childhood Special Education (3 credits)
Also offered as: EDSP420. Credit only granted for: EDSP420 or EDSP626.
Focus on developmental, behavioral, and learning characteristics of infants and young children with and without disabilities.

EDSP 627 Curriculum and Instruction: Early Childhood Special Education (3 credits)
Also offered as: EDSP422. Credit only granted for: EDSP422 or EDSP627.
Curriculum and instructor for young children with mild and moderate disabilities, preschool through primary grades.

EDSP 631 Early Intervention: Early Childhood Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP430. Credit only granted for: EDSP430 or EDSP631.
Intervention with infants and young children with disabilities. Focus on moderate and severe disabilities.

EDSP 635 Seminar: Behavioral Disorders (3 credits)
Prerequisite: EDSP470. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Methodological and theoretical issues related to students with behavioral disorders.

EDSP 640 Seminar: Learning Disorders (3 credits)
Prerequisite: EDSP470. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Research and theoretical material relevant to trends and practices regarding students with learning disorders.

EDSP 650 Seminar in Early Childhood Special Education (3 credits)
Prerequisite: 9 credits in EDSP courses; and (EDSP600 and EDSP420). Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Pertinent psychological, educational, medical, and sociological material relevant to trends and practices regarding handicapped infants and preschool children.

EDSP 651 Program Planning and Instruction for Handicapped Infants and Children (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in EDSP430; or students who have taken courses with comparable content may contact the department.
Program design for serving high risk and handicapped infants from birth to three years of age.

EDSP 652 Curriculum and Instruction: Elementary Special Education (3 credits)
Also offered as: EDSP652, EDSP652. Credit only granted for: EDSP451 or EDSP652.
Methods for instruction of students with disabilities in the general education curriculum. Collaboration with other professionals is included.

EDSP 653 Methods and Models of Instruction: Elementary Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP453. Credit only granted for: EDSP453 or EDSP653.
Focus on models and methods of instruction responsive to the cognitive, linguistic, and cultural characteristics of elementary students in special education.

EDSP 654 Assessment in Elementary Special Education (3 credits)
Also offered as: EDSP455. Credit only granted for: EDSP455 or EDSP654.
Focus on selection, administration, and interpretation of assessment tools and results for designing instruction and evaluating progress of elementary students in special education.

EDSP 655 Seminar in Secondary and Transition Special Education (3 credits)
Prerequisite: EDSP600. And EDSP464; or EDSP412. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Review of research pertaining to individuals with disabilities in secondary and post-secondary vocational and transitional settings.

EDSP 660 Research to Practice in Special Education (3 credits)
Prerequisite: EDSP470. Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program.
Graduate seminar for students in the teacher preparation program in special education. Focuses on issues in research, methodologies and applications of current research with students having disabilities.

EDSP 664 Issues and Models:Secondary/Middle Special Education (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP466. Credit only granted for: EDSP466 or EDSP664.
Issues, legislation, and service models in secondary/middle special education. Emphasis on career and vocational education, self-determination, and transition.

EDSP 665 Families, Culture, and Disability (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Current research on service delivery and cultural factors that influence families of children and youth with disabilities.

EDSP 670 Single Subject Research Designs (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Design, application, and analysis of single subject research in special education classrooms across all disabilities.

EDSP 671 Qualitative Methodologies in Special Education (3 credits)
Prerequisite: EDSP600. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Design and evaluation of qualitative research in special education across disabilities and ages.

EDSP 673 Evaluating Evidence-Based Practices in Special Education (3 credits)
Prerequisite: EDMS645. Recommended: EDSP670 and EDSP600. Credit only granted for: EDSP673 or EDSP798E. Formerly: EDSP798E.
Evaluating evidence-based practices in special education, by examining theoretical origins, use of causal designs, programmatic lines of research, and research syntheses to explore the development of what it means for an intervention to have the potential to significantly impact practice.

EDSP 674 Assessment in Middle/Secondary Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP474. Credit only granted for: EDSP474 or EDSP674.
Cognitive, vocational, and social assessment for students with disabilities. Emphasis on interpretation of assessment results and case management practices.

EDSP 675 Legal and Policy Foundations for Individuals with Disabilities (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Regulatory and statutory foundations for public policies addressing the education of children and youth with disabilities.

EDSP 677 Curriculum, Assessment, and Instruction: Middle/Secondary Special Education (3 credits)
Also offered as: EDSP477. Credit only granted for: EDSP477 or EDSP677.
Methods and assessment practicies for effective instruction in middle and secondary content areas for students in special education.

EDSP 678 Seminar in Special Education (3 credits)

EDSP 681 Seminar in Cultural Diversity and Disability (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP481. Credit only granted for: EDSP481 or EDSP681.
A study of diversity issues within special education, with attention to issues of race, culture, and disability as they pertain to teaching, learning, and social justice.

EDSP 682 Advanced Literacy Approaches for At-Risk Adolescents (3 credits)
Also offered as: EDSP482. Credit only granted for: EDSP482, EDSP488R, EDSP682, or EDSP788R. Formerly: EDSP788R.
Approaches to teaching reading in the

content areas for secondary students with disabilities.

EDSP 683 Assessment and Instruction in Mathematics in Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP485. Credit only granted for: EDSP485 or EDSP683.
Instructional methods and assessment in mathematics in special education.

EDSP 684 Reading and Writing Instruction in Special Education II (3 credits)
Prerequisite: EDSP616. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP484. Credit only granted for: EDSP484 or EDSP684.
Development of effective reading and writing programs for students receiving special education services. Builds on the foundation established in EDSP 616.

EDSP 685 Policy Formulation and Persons with Disabilities (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Research into the process by which policies regarding persons with disabilities are formulated, implemented and evaluated.

EDSP 686 Promoting Prosocial Behavior in Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program; or permission of EDUC-Counseling, Higher Education and Special Education department. Also offered as: EDSP486. Credit only granted for: EDSP486 or EDSP686.
Focuses on effective practices for social development among students with disabilities. Classroom, school, and community approaches for developing prosocial behavior are covered.

EDSP 687 Family Partnerships in Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Also offered as: EDSP487. Credit only granted for: EDSP487 or EDSP687.
Strategies for communicating and working with families of students with disabilities.

EDSP 690 Teacher Candidate Research Seminar in Special Education (3 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program.
Required seminar for master's certification teacher candidates in special education focusing on research methods and applications with students having disabilities.

EDSP 691 Graduate Internship in Special Education I: Early Childhood (2-4 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Credit only granted for: EDSP431 and EDSP691. Formerly: EDSP431.
Internship I in early childhood special education.

EDSP 692 Graduate Internship in Special Education I: Elementary (2-4 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Credit only granted for: EDSP456 or EDSP692. Formerly: EDSP456.
Internship I in elementary special education.

EDSP 693 Graduate Internship in Special Education I: Secondary Middle (2-4 credits)
Restriction: Must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Credit only granted for: EDSP436 or EDSP693. Formerly: EDSP436.
Internship I in secondary middle special education.

EDSP 694 Graduate Internship in Special Education II: Early Childhood (6-11 credits)
Corequisite: EDSP690. Restriction: Must be in Special Education program; or must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Credit only granted for: EDSP494, EDSP694, or EDSP889A.
Student teaching, full-time for twelve weeks, with infants or preschool children with disabilities.

EDSP 695 Graduate Internship in Special Education II: Elementary (6-11 credits)
Corequisite: EDSP690. Restriction: Must be in Special Education program; or must be in Special Education (Doctoral) program; or must not be in Special Education (Master's) program. Credit only granted for: EDSP495, EDSP694, or EDSP888A.
Student teaching, full-time for twelve weeks, with students with disabilities in elementary settings.

EDSP 696 Graduate Internship in Special Education II: Secondary Middle (6-11 credits)
Corequisite: EDSP690. Restriction: Must be in Special Education program; or must be in Special Education (Doctoral) program; or must be in Special Education (Master's) program. Credit only granted for: EDSP496, EDSP696, or EDSP889A.
Student teaching, full-time for twelve weeks, with students with disabilities in secondary or middle school settings.

EDSP 788 Selected Topics in Special Education (1-3 credits)
Repeatable to 6 credits if content differs.
Current topics and issues in teacher education.

EDSP 798 Special Problems in Special Education (1-6 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Intended for Master's, AGS, or doctoral students in education who desire to pursue a research problem.

EDSP 799 Master's Thesis Research (1-6 credits)
Registration required to the extent of six hours for Master's thesis.

EDSP 860 Doctoral Research Seminar (3 credits)
Issues and procedures relevant to conducting and analyzing research in special education.

EDSP 872 Theory and Empirical Design in Educational Research (3 credits)
Prerequisite: EDMS645 and EDMS646; or permission of EDUC-Counseling, Higher Education and Special Education department. Restriction: Must be in Special Education (Doctoral) program. Credit only granted for: EDSP672 or EDSP872. Formerly: EDSP672.
Design and evaluation of quantitative research in special education across disabilities and ages.

EDSP 875 Policy Issues Affecting Individuals with Disabilities (3 credits)
Restriction: Permission of instructor; or must be in Special Education (Doctoral)

program; or must be in Special Education (Master's) program.
An analysis of current educational and disability issues and policies pertaining to children, youth, and adults with disabilities.

EDSP 888 Apprenticeship in Special Education (1-8 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDSP 889 Internship in Special Education (3-8 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDSP 898 Pre-Candidacy Research (1-8 credits)

EDSP 899 Doctoral Dissertation Research (1-8 credits)
Registration required to the extent of 6-9 hours for an Ed.D. Project and 12-18 hours for a Ph.D. dissertation.

Education (EDUC)

EDUC 475 Mindtools for Investigation and Education (3 credits)
Restriction: Junior standing or higher; and permission of EDUC-College of Education.
Explore educational games, simulations and computer modeling platforms common to many domains from a variety of fields. Focus on design and research issues pertinent to learning through simulations and games.

EDUC 476 Assessment and Design Strategies for Improving Student Learning: Utilizing Data with Technology Tool (3 credits)
Restriction: Permission of EDUC-College of Education.
Explore systemic improvement strategies to curriculum planning, assessment, and instruction through utilizing data and data analysis via technology tools. It is designed to assist educators in identifying and using data that are most effective in assisting improvement of student achievement and system efficacy.

EDUC 477 Assistive Technology for the Classroom Setting (3 credits)
Restriction: Permission of EDUC-College of Education; and junior standing or higher.
Designed to be an introductory survey course for educators in the application of assistive technology in the general classroom setting. Students will be introduced to various assistive technologies and strategies.

EDUC 478 Using Information Technology in Schools (1-3 credits)
Restriction: Permission of EDUC-College of Education; and junior standing or higher. Repeatable to 6 credits if content differs.
Strategies, resources, tools and organizational concepts for using technology to facilitate classroom learning and school administrative functions.

EDUC 498 Selected Topics in Education (1-3 credits)
Restriction: Permission of EDUC-College of Education. Repeatable to 9 credits if content differs.
Current topics and issues in education.

EDUC 499 Honors Thesis (1-6 credits)
Prerequisite: Admission to College Honors Program. Restriction: Permission of EDUC-College of Education.
Individual thesis work under supervision of faculty advisors; includes periodic seminar meetings with other honors students engaged in thesis work.

EDUC 578 Special Topics on Teaching and Learning (1-3 credits)
Restriction: Permission of EDUC-College of Education. Repeatable to 18 credits if content differs.
Experienced educators experience and study specific topics in instructions and develop applications for classroom and other settings in a collaborative workshop setting to support teacher improvement and learner achievement

EDUC 588 Special Topics on Curriculum (1-3 credits)
Restriction: Permission of EDUC-College of Education. Repeatable to 18 credits if content differs.
Experienced teachers and other educators study topics in a content curriculum area and develop applications for classroom and/or non-formal instructional settings in a collaborative workshops or seminar setting to support curriculum enhancement and revision.

EDUC 589 Professional Development Practicum (1-3 credits)
Restriction: Permission of EDUC-College of Education. Repeatable to 18 credits if content differs.
Experienced teachers and other educators practice and study their instructional practices in their own classrooms as part of collaborative professional devleopment aimed at supporting teaching improvement and learner achievement.

EDUC 698 Advanced Topics in Education (1-3 credits)
Restriction: Permission of EDUC-College of Education. Repeatable to 6 credits if content differs.
Arranged study on specific topics in education.

EDUC 888 Applied Apprenticeship in Education (1-3 credits)
Restriction: Permission of EDUC-College of Education. Repeatable to 12 credits.
Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals.

EDUC 898 Pre-Candidacy Research (2-4 credits)
Repeatable to 12 credits.
Pre-Candidacy Research

EDUC 899 Dissertation of Practice Research (1-6 credits)
Repeatable to 9 credits.
Registration required to the extent of 6-9 hours for an Ed.D. Dissertation.

Executive MBA Program (EMBA)

EMBA 610 Introduction to Financial Accounting (2 credits)
Restriction: Must be in Executive MBA program.
Overview of financial accounting, periodic financial statements and the financial reporting process. Importance of financial statements as information source for creditors and investors and as a means by which managers can communicate information about their firms.

EMBA 611 Managerial Accounting (2 credits)
Restriction: Must be in Executive MBA program.
Use of accounting data in corporate planning and control. Cost-volume- profit

analysis, budgeting, pricing decisions and cost data, transfer pricing, activity-based management, performance measures, and standard costing.

EMBA 616 Accounting for Senior Management (3 credits)
Restriction: Must be in Executive MBA program.
This course is designed to give senior managers an overview of basic financial and managerial accounting principles and tools with emphasis on those principles and tools they can use to support various managerial decision-making tasks.

EMBA 617 Accounting for Decision Making (4 credits)
Restriction: Must be in Executive MBA program.
An overview of financial accounting including the emphasis on periodic financial statements, the financial reporting process, the importance of financial statements as (i) an information source for creditors and investors and (ii) a means by which managers can communicate information about their firms. Overview of managerial accounting in corporate planning and control. Specific facets include cost-volume- profit analysis, budgeting, pricing decisions and cost data, transfer pricing, activity-based management, performance measures, and standard costing.

EMBA 620 Strategic Information Systems (2 credits)
Restriction: Must be in Executive MBA program.
Use of information technology to achieve competitive advantage, efficient operations, and effective decision making. Analysis of functions of information technology and its impact on competitive strategy and organizational operations.

EMBA 621 Strategic and Transformational Information Technology (3 credits)
Restriction: Must be in Executive MBA program.
Use of information technology to achieve competitive advantage, effcient operations, and effective decision making. Analysis of functions of information technology and its impact on competitive strategy and organizational operations.

EMBA 627 Data Analysis and Decision Modeling (4 credits)
Restriction: Must be in Executive MBA program.
Introduces participants to contemporary techniques for arriving at optimal managerial decisions. It draws on fundamental ideas in the fields of statistics and operations research, and demonstrates their application in modern business decision-making.

EMBA 630 Data Models and Decisions (3 credits)
Restriction: Must be in Executive MBA program.
To develop probabilistic and statistical concepts, methods and models through examples motivated by real-life data from business and to stress the role that statistics play in the managerial decision making process.

EMBA 632 Corporate Finance I (2 credits)
Restriction: Must be in Executive MBA program.
This course introduces valuation methods in finance. Executive MBA students will learn the basic techniques and language of finance, and will be introduced to some of the responsibilities of the corporate financial manager. In particular, the following issues will be addressed: "The objective of creating shareholder value;" "Valuation of corporate securities, including stocks and bonds;" "The risk-return relationship and its implications for finance." Financial techniques for evaluating corporate investments.

EMBA 633 Corporate Finance II (2 credits)
Restriction: Must be in Executive MBA program.
This course builds on the concepts and analytic methods covered in Corporate Finance I. Executive MBA students will learn about the structure of financial markets, the financing and payout choices of large and small corporations, and the role of risk management in the corporation. In particular, the following issues will be addressed: "Thedrivers of shareholder value;" "Corporate financing alternatives and the design of a company's capital structure;" "Coordinating investment, financing and payout policies;" "Corporate Finance Issues for Start-up firms;" Key issues in international corporate finance."

EMBA 637 Corporate Finance (4 credits)
Restriction: Must be in Executive MBA program.
Presents key concepts in corporate finance as well as tools used in making corporate financial decisions. Topics include valuation of corporate securities, capital investment decision making, capital market theory, operation and efficiency of financial markets, corporate financing decisions, and risk management.

EMBA 640 Financial Management (3 credits)
Restriction: Must be in Executive MBA program.
Analysis of major corporate financial decisions using a market-oriented framework. Topics include capital budgeting, security portfolio theory, operation and efficiency of financial markets, options pricing, financing decisions, capital structure, payout policy and international finance.

EMBA 646 Global Economics and Public Policy (3 credits)
Restriction: Must be in Executive MBA program.
This course is intended to provide the student with a basic introduction to the microeconomics of the firm. The emphasis will be on the firm decision making process and how that process influences firm performance. Firm performance can have many dimensions, although this course will primarily concern itself with profitability. This course will examine the market environment of the firm and the role of government in the global market. Topics to be covered include the basic microeconomic principles that firms utilize in making business decisions, including demand, elasticities, costs, productivity, and pricing. In addition we will examine the industry environment that the firm faces including the concepts of market structure, market conduct and market performance.

EMBA 647 Economics and Public Policy (4 credits)
Restriction: Must be in Executive MBA program.
Introduction to the economic concepts essential to business decision-making. Concepts covered include supply, demand, cost pricing, competition, monopoly, non-competitive markets, game theory, vertical integration, regulation, national income accounting, fiscal policy, monetary policy, balance of payments accounting, exchange rates and international economics. Primary attention is given to cases.

EMBA 650 Marketing Management (2 credits)
Restriction: Must be in Executive MBA program.
Analysis of marketing problems and evaluation of specific marketing efforts regarding the organization's products and services, pricing activities, channel selection, and promotion strategies in both domestic and international markets.

EMBA 653 Corporate Venturing (1-3 credits)
Restriction: Must be in Executive MBA program.
One of the key questions this course will help answer is why certain companies are so much better at developing and launching new ventures from the inside than others. We will investigate what it takes to create an entrepreneurial and start-up culture in an established organization. Another critical goal of the class is to help you become a better Intrapreneur. Similar to Entrepreneurs in start-up companies, the skills, knowledge, motivation and preseverance of the individual who champions a new venture are critical success factors.

EMBA 654 Organizational Change (1-3 credits)
Restriction: Must be in Executive MBA program.
This course is designed to assist you in developing the skills necessary to successfully manage change in a turbulent environment. As part of the course design, an overview of organizational change management strategies aimed at improving the organization's ability to cope with change will be covered. In addition, the course provides students with the models for understanding the dynamics of organizational change. Change management skills are among the most important skills that any professional can possess.

EMBA 656 Leadership and Human Capital (3 credits)
Restriction: Must be in Executive MBA program.
The overall objective of this course is to sensitize participants to the fact that managers face many dilemmas (such as the need to maintain control, yet be flexible enough to effectively change as the competitive environment requires); and therefore, managers need to have skills that will enable them to effectively manage and lead, and thus to become leader-managers. How managing versus leading-skills differ will be emphasized in this course. To raise participants' sensitivity to managerial dilemmas and the skills needed to effectively manage these, there will be extensive use of case discussions and video-clips about challenges faced by companies and their managers, and extensive opportunities for self-reflective and experiential exercises. The development of action-plans for implementing a desirable change in participants' current job-situation will also help participants to hone the skills needed to be effective change-agents, hence leaders, in their organization.

EMBA 657 Leadership and Human Capital (4 credits)
Restriction: Must be in Executive MBA program.
Develops competencies critical for executive success including communication skills (verbal, written, listening), interpersonal sensitivity, teamwork, analytical thinking, decision-making skills, and planning and organizing. Topics for discussion include: leadership, power and influence, empowerment, strategic vision, communication and negotiation, conflict, staffing, legal issues & requirements with human capital, training, mentoring, career development, succession planning, motivation, performance management, goal setting, feedback, coaching, rewards & incentives, discipline, designing and building effective teams, and change management.

EMBA 662 Leadership and Teamwork (2 credits)
Restriction: Must be in Executive MBA program.
Course examines concepts of team-building and leadership which are critical to managerial success. Topics include leadership, decision- making, communication and conflict, work motivation, building effective teams, and organizational change and culture.

EMBA 663 Managing Human Capital (2 credits)
Restriction: Must be in Executive MBA program.
Course examines core human resource management principles and emphasizes skills for maximizing an organization's human capital. Topics include recruitment, selection, performance feedback and incentives, termination of poor performers, and managing organizational change through human resource systems and policies.

EMBA 664 IT Transformation of Organizations, Industries and Markets (2 credits)
Restriction: Must be in Executive MBA program.
Information technology enables the transformation of organizations, industries and markets. The purpose of this course is to understand the forces within organizations and industries that combine with the technology to create these transformations. The course focuses on general models of transformation as well as case studies of specific organizations and industries. Teams of students will select an industry and prepare a report on how technology is now or will transform it, and examine the implications for how businesses will function in the future.

EMBA 667 Information Systems Management (4 credits)
Restriction: Must be in Executive MBA program.
Introduces the key issues in managing information technology; and stresses management's role in creating the Netcentric firm. Topics include IT and its relationship to corporate strategy, technology itself, the value and return from IT investments, the major functional applications of technology, and organization transformation with IT.

EMBA 671 Supply Chain Logistics and Operations Management (2 credits)
Restriction: Must be in Executive MBA program.
This course introduces students to the concept of value-driven supply chains and its integration with operations. The course focuses on the fundamental principles underlying supply chains, using insights from both operations management and logistics.

EMBA 674 Marketing Simulation (2 credits)
Prerequisite: Must have completed Marketing Management or Marketing Strategy coursework. Restriction: Must be in Executive MBA program.
This is a capstone marketing course that is taught primarily through the simulation MARKSTRAT. As we go through the simulation we will discuss marketing strategies designed to manage products in selected market segments. Topics covered include competitor analysis, buyer analysis, market segments, and product strengths and weaknesses; product related issues are identified and marketing strategies developed, assessed and implemented. The material is then complemented with the MARKSTRAT simulation. The prerequisite for this course is Marketing Management or Marketing Strategy.

EMBA 677 Business and Product Marketing Strategy (4 credits)
Restriction: Must be in Executive MBA program.
Analysis of marketing problems and the design and evaluation of business-level marketing strategies that encompass the organization's products and services, pricing activities, channel selection, and promotion strategies. Theories, concepts and tools synthesized via a computer-based marketing strategy simulation game. Stresses marketing strategy development and implementation activities.

EMBA 678 Ethical Leadership (1-3 credits)
Restriction: Must be in Executive MBA program. Repeatable to 3 credits if content differs.
This course will explore the following topics; Recognize the scope of managerial agency and the economic, legal and ethical responsibilities to various stakeholders, Conduct elementary ethical analyses of managerial situations using the principal schools of ethical reasoning, Identify the economic and ethical properties of a market mechanism, and the means for addressing the limitations of a market, and Recognize ethical leadership as the exercise of managerial agency in changing existing values and practices.

EMBA 681 Managerial Economics and Public Policy (2 credits)
Restriction: Must be in Executive MBA program.
Basic microeconomic principles used by firms, including supply and demand, elasticities, costs, productivity, pricing, marketing structure and competitive implications of alternative market structures. Market failures and government intervention. Public policy processes affecting business operations.

EMBA 683 The Global Economic Environment (2 credits)
Restriction: Must be in Executive MBA program.
Relationship between national and international economic environments. Determinants of output, interest rates, prices and exchange rates. Analysis of effect of economic policies (fiscal, monetary, trade, tax) on the firm and the economy.

EMBA 684 Global Strategy (2 credits)
Restriction: Must be in Executive MBA program.
This course focuses on the strategic and organizational challenges facing the multinational firm. The types of questions that we address are: Why do firms go abroad? What differentiates a "global" from a "multidomestic" industry? What are the sources of competitive advantage in a global context? How does a multinational company play the global chess game? Why and when do/should companies engage in cross-border strategic alliances? What are the associated risks and how to guard against them? What potential roles can foreign subsidiaries play in an MNC's global strategy? How do companies choose an optimal global structure? How do companies ensure coordination between the center and the subsidiaries and among subsidiaries? How do companies manage strategic change from one type of global strategy to another?

EMBA 685 Competitive Strategy (2 credits)
Restriction: Must be in Executive MBA program.
This course will focus on the fundamental strategic questions that all general managers, and other members of any company's leadership team, face: How to analyze the structure and evolutionary path of the industry that you are in, how to decide what businesses to stay in, newly enter, or exit, and how to compete in each of the businesses that you choose to be in. With the goal of understanding the key concepts and logic that should guide managers in making these decisions wisely, we will focus on the following more specific topics: what is strategy, analyzing industry structure and industry dynamics, dynamics of competition and creation of competitive advantage, the logic of strategic alliances, and new business creation.

EMBA 686 Competition, Strategy and Globalization (3 credits)
Restriction: Must be in Executive MBA program.
This course will focus on the fundamental strategic questions that general managers and other members of any company's leadership team face in today's dynamic and global environment: (a) how to analyze the global structure and the evolutionary path of the industry that you compete in,(b) how to decide what businesses to stay in, to newly enter, or to exit,(c) how to create sustainable competitive advantage, (d) how to design global expansion strategies, and (e) how to convert global competitive advantage.

EMBA 687 Strategy and Globalization (4 credits)
Restriction: Must be in Executive MBA program.
Focuses on strategy formulation and implementation in domestic and global settings. Topics include: Industry and competitor analysis, industry and firm value chain, coherence in overall and functional strategies, developing global strategies, leadership, goal setting, organizational structure, and culture. Course utilizes case studies from a variety of settings and emphasizes the evaluation and selection of strategic choices.

EMBA 688 Strategic Management (1 credits)
Restriction: Must be in Executive MBA program. Repeatable to 3 credits if content differs.
This course aims to give you the tools, frameworks, and ideas necessary to develop business units and corporate strategies for your oraganizations that fit, both in the short run and long run. As noted above, this requires that we appreciate how best to analyze and identify profit opportunities and threats in different industies and competitive environments; how best to analyze and identify your organization's valuable assets, resources and capabilities and how they might be protected, leveraged, and extended inthe market; how to organize your firm to be best prepared to adapt its strategy over time as the market environment changes; how to use organic growth as well as mergers, acquisitions, joint ventures, alliances, and divestitures to ensure that your organization around its strategy to maximize the probability of successful strategy implementation.

EMBA 690 Strategic Management (2 credits)
Restriction: Must be in Executive MBA program.
Integrative strategic management focusing on strategy formulation and implementation in domestic and global settings. Industry and competitor analysis, industry and firm value chain, leadership, goal setting, organizational structure and culture. Case study approach to top management and organizational problems.

EMBA 693 Supply Chain (2 credits)
Restriction: Must be in Executive MBA program.
The age of the real-time supply chain has finally arrived. Companies can now connect instantaneously with suppliers, distributors, manufacturers, customers, and alliance partners around the world. On-line access to up-to-the minute information enables companies to improve communication and project management across the entire supply chain, promote collaboration across departments, and enhance customer service and financial operations. The results are stunning; for example, a recent survey reports dramatic increases in revenues and customer retention and decreases in operating costs and product cycle times. As competition heats up from every direction, the ability to design and manage your supply chain with precision and speed becomes a business imperative. This course offers a practical blueprint for building, implementing, and sustaining supply chains in today's rapidly changing environment.

EMBA 694 Operations Management (2 credits)
Restriction: Must be in Executive MBA program.
A firm has the opportunity to create competitive advantage through proficient management of its operations. To do so, the firm must first recognize and establish the strategic role of its operations within the organization. Then, at the more detailed operational level, the firm must execute effectively and efficiently. This course examines the strategic role that the operations function can play, and offers specific tools and techniques that the firm can use for strategy execution. We cover concepts of operations managment applied to both manufacturing and services, including operations strategy, analysis of process flows and bottlenecks, waiting line models, total quality management, six sigma, and revenue management.

EMBA 697 Supply Chain Management (4 credits)
Restriction: Must be in Executive MBA program.
Introduces students to the concept of value-driven supply chains and its integration with operations. It illustrates the design and management of effective supply chains, based on the principles developed and the current practices of firms, illustrated with case studies.

EMBA 711 Financial Planning and Control Systems (2 credits)
Restriction: Must be in Executive MBA program.
The role accounting plays in planning and controlling issues within organizations. It takes a high-level view of planning and control and will encourage you to take a very broad view of the topic.

EMBA 724 International Financial Management (3 credits)
Prerequisite: EMBA640. Restriction: Must be in Executive MBA program.
The role of financial management in the multinational firm. The financing and managing of foreign investments, assets,

currencies, imports and exports. National and international financial institutions and markets.

EMBA 732 Supply Chain Management (3 credits)

Restriction: Must be in Executive MBA program.

This course allows students to experience the real-time world of a glo bal supply chain manager through a simulation experience, the Global Supply Chain game. Additionally, it covers the following topics: supply chain leadership; multi-channeled demand and supply management; and supply chains as a system. Additionally, this course discusses the architecture, software, and technology of the real-time supply chains. It provides an analysis of the process improvements and steps required for firms to re-engineer their supply chains in order to reach the new model. As part of this re-engineering process, there is a discussion of agile manufacturing as well as the role of third party logistics providers. A final section is devoted to the globalization of supply chains.

EMBA 751 Implementing Strategy (3 credits)

Restriction: Must be in Executive MBA program.

Organizational dynamics of competitive advantage. Impact of alternative organizational structures, planning and control systems, human resource management practices, and executive leadership styles on the implementation of archetypically different strategies.

EMBA 757 Marketing Strategy (3 credits)

Restriction: Must be in Executive MBA program.

A capstone marketing course. Marketing strategies designed to manage products in selected market segments. Topics covered include competitor analysis, buyer analysis, market segments, and product strengths and weaknesses; product related issues are identified and marketing strategies developed, assessed and implemented.

EMBA 758 Special Topics (2-3 credits)

Restriction: Must be in Executive MBA program. Repeatable to 12 credits if content differs.

Selected advanced topics in the various fields of graduate study in business.

EMBA 759 Independent Study (1-6 credits)

Restriction: Must be in Executive MBA program. Repeatable to 12 credits if content differs.

Independent study for Masters students in Business.

EMBA 775 Pricing and Revenue Management (1-3 credits)

Restriction: Must be in Executive MBA program.

Specialized course on pricing and revenue management (PRM) that provides students with tools and principles, drawn from several disciplines (Operations, Microeconomics, Decision Modeling, Statistics, Marketing, IS) to make effective pricing decisions. Topics covered include economics of pricing, strategy and tactics of PRM, pricing optimization, differentiated pricing, dynamic pricing, mark-down pricing, legal and ethical issues in models/methods used in making effective PRM decisions and managerial or organizational factors that hold the key to success inexecution of PRM.

EMBA 778 Special Topics (2-3 credits)

Selected advanced topics in the various fields of graduate study in business.

EMBA 788 Executive Skills Mastery (1-2 credits)

Repeatable to 12 credits if content differs. Formerly: BMGT788A.

This course is designed to focus on the development of the specific set of skills that executives need to successfully perform in today's organizational environment. Students complete assessments which help to target their specific skill level and in the aggregate give instructors clear ideas on the needs of the cohort. The assessments also augment executive coaching, when provided. This is typically registered as a one credit course except when a particular program's cirriculum allocates enough contact hours to all course topics to be covered at a more advanced level.

EMBA 789 Leadership Mastery (1-2 credits)

Repeatable to 12 credits if content differs. Formerly: BMGT788B.

This course addresses organizational challenges from the CEO or C-level perspective. At this level, the ability to engage ambiguity and chaos effectively is essential. Creating strategy while using a systems approach and understanding how each functional area interacts with the other (with both the short-term and long-term in mind) are of very high importance. The course covers topics that consume the days of senior level leaders in organizations. This is typically registered as a one credit course except when a particular program's cirriculum allocates enough contact hours to all course topics to be covered at a more advanced level.

EMBA 790 Management of Technology (3 credits)

Restriction: Must be in Executive MBA program.

Students are introduced to a variety of strategic and operational issues that arise when managing in the presence of technological innovation, and provides techniques to approach these issues. Topics include the formulation of innovation strategies, technology diffusion and forecasting, the process of developing new products and services, productivity measurement, and the implementation of process technologies aimed at improving productivity (manufacturing and services).

EMBA 798 Action Learning Project (1-2 credits)

Repeatable to 9 credits if content differs.

This course is designed to give the student the opportunity to work on a real-time, salient business challenge or issue for the sponsoring organization. This is often the student's employer. Students are encouraged to design projects which extend beyond a single functional area and require them to examine the interaction of multiple functional areas from a systems perspective. Students work in teams for the projects. This allows them to learn from one another, as well as to learn how to work more effectively in teams - especially in a largely virtual environment. This is typically a two credit course when projects are initiated and completed entirely within a single term. It may be a one credit course when projects extend over more than one term.

Engineering, Aerospace (ENAE)

ENAE 403 Aircraft Flight Dynamics (3 credits)

Prerequisite: ENAE414 and ENAE432. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.

Study of motion of aircraft, equations of motion, aerodynamic force representation, longitudinal and lateral motions, response to controls and to atmospheric disturbances, handling qualities criteria and other figures of merit.

ENAE 404 Space Flight Dynamics (3 credits)

Prerequisite: ENAE301. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.

Three-dimensional motion under central fields. Solutions to orbital motion, orbital elements, time elements. Kepler's laws. Orbital maneuvering, rendezvous and station-keeping. Rigid-body attitude dynamics, spacecraft attitude dynamics.

ENAE 414 Aerodynamics II (3 credits)

Prerequisite: ENAE311. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department. And junior standing or higher.

Aerodynamics of inviscid incompressible

flows. Aerodynamic forces and moments. Fluid statics/buoyancy force. Vorticity, circulation, the stream function and the velocity potential. Bernoulli's and Laplace's equations. Flows in low speed wind tunnels and airspeed measurement. Potential flows involving sources and sinks, doublets, and vortices. Development of the theory of airfoils and wings.

ENAE 415 Helicopter Theory (3 credits)
Prerequisite: ENAE414. Restriction: Must be in Engineering: Aerospace program.
Elementary exposition on the theory and practice of aerodynamics applied to helicopters and other rotary wing aircraft.

ENAE 420 Computational Structural Mechanics (3 credits)
Prerequisite: ENES220 and MATH241; and must have completed a course in linear algebra. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Introductory of finite element methods for aerospace engineering modeling and analysis; equips students with ability to understand manuals of commercial finite element analysis software.

ENAE 423 Vibration and Aeroelasticity (3 credits)
Prerequisite: ENAE324. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Dynamic response of single and multiple degrees of freedom systems, finite element modeling, wing divergence, aileron reversal, wing and panel flutter.

ENAE 425 Mechanics of Composite Structures (3 credits)
Prerequisite: MATH246, ENAE324, ENES220, and MATH241.
Introduction to structures composed of composite materials and their applications in aerospace. In particular, filamentary composite materials are studied. Material types and fabrication techniques, material properties, micromechanics, anisotropic elasticity, introduction to failure concepts.

ENAE 432 Control of Aerospace Systems (3 credits)
Prerequisite: Minimum grade of C- in ENAE301 and ENAE283. Restriction: Junior standing or higher; and must be in Engineering: Aerospace program.
An introduction to the feedback control of dynamic systems. Laplace transforms and transfer function techniques; frequency response and Bode diagrams. Stability analysis via root locus and Nyquist techniques. Performance specifications in time and frequency domains, and design of compensation strategies to meet performance goals.

ENAE 441 Space Navigation and Guidance (3 credits)
Prerequisite: ENAE404 and ENAE432. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Principles of navigation. Celestial, radio, and inertial navigation schemes. Navigational and guidance requirements for orbital, planetary, and atmospheric entry missions. Fundamentals of communications and information theory. Link budgets, antennas and telemetry systems.

ENAE 455 Aircraft Propulsion and Power (3 credits)
Prerequisite: ENES232, ENAE414, and ENAE311. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Thermodynamic cycle analysis, aerothermochemistry of fuels and propellants, operating principles of piston, turbojet, fanjet, and other variations of airbreathing aircraft power units.

ENAE 457 Space Propulsion and Power (3 credits)
Prerequisite: PHYS271, ENES232, PHYS270, and ENAE311. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department. And senior standing.
Thermodynamic cycle analysis, aerothermochemistry of fuels and propellants, operating principles of rocket, ion, and other exoatmospheric power units.

ENAE 464 Aerospace Engineering Laboratory (3 credits)
Prerequisite: ENAE324, ENAE362, ENAE311, and ENAE432. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Application of fundamental measuring techniques to measurements in aerospace engineering. Includes experiments in aerodynamics, structures, propulsion, flight dynamics and astrodynamics. Correlation of theory with experimental results.

ENAE 471 Aircraft Flight Testing (3 credits)
Prerequisite: ENAE414. Corequisite: ENAE403. Restriction: Must be in Engineering: Aerospace program.
Provides basic instruction to aircraft flight testing and demonstrates need for systematic, well-proven technique to allow for accurate airplane performance. Concepts of aerodynamics, airplane performance, and stability and control. Emphasis on single-engine general aviation type aircraft.

ENAE 481 Principles of Aircraft Design (3 credits)
Prerequisite: ENAE324, ENAE362, and ENAE432. Corequisite: ENAE414. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Aircraft design principles blending both synthesis and analysis. The iterative nature of the design process. Applied aerodynamics. Elements of aircraft performance calculation and optimization. Design of aircraft including payload, crew and avionics provisions, propulsion selection and sizing, aerodynamic configuration optimization, mass properties, stability and control characteristics, and vehicle subsystems. Individual student projects in aircraft design.

ENAE 482 Aeronautical Systems Design (3 credits)
Prerequisite: ENAE455, ENAE423, ENAE403, and ENAE481. Restriction: Must be in Engineering: Aerospace program; and senior standing or higher.
Senior capstone design course in the aeronautics track. Introduction of computerized methods for sizing and performance analysis. More comprehensive methods to predict weight, aerodynamics and propulsion system characteristics. Consideration in design disciplines such as vulnerability, maintainability, produceability, etc. Groups of students will complete, brief and report on a major design study to specific requirements.

ENAE 483 Principles of Space Systems Design (3 credits)
Prerequisite: ENAE404, ENAE324, ENAE362, and ENAE432. Restriction: Must be in Engineering: Aerospace program; or permission of ENGR-Aerospace Engineering department.
Principles of space systems analysis and vehicle design. Launch vehicle performance analysis and optimization. Design of vehicle systems including avionics, power, propulsion, life support, human factors, structures, actuator and mechanisms, and thermal control. Design processes and design synthesis. Individual student projects in vehicle design.

ENAE 484 Space Systems Design (3 credits)
Prerequisite: ENAE423, ENAE483, ENAE441, and ENAE457. Restriction: Must be in Engineering: Aerospace program.
Senior capstone design course in the space track. Group preliminary design of a space system, including system and

subsystem design, configuration control, costing, risk analysis, and programmatic development. Course also emphasizes written and oral engineering communications.

ENAE 488 Topics in Aerospace Engineering (1-4 credits)

Prerequisite: Permission of student's advisor required. Restriction: Permission of instructor.

Technical elective taken with the permission of the student's advisor and instructor. Lecture and conference courses designed to extend the student's understanding of aerospace engineering. Current topics are emphasized.

ENAE 499 Elective Research (3 credits)

Prerequisite: Permission from student's advisor required. Restriction: Senior standing or higher; and must be in Engineering: Aerospace program; and permission of instructor; and permission of ENGR-Aerospace Engineering department. Repeatable to 6 credits if content differs.

Undergraduate research project and paper conducted under the direction of an aerospace engineering faculty member to be presented at a conference or competition.

ENAE 601 Astrodynamics (3 credits)

Prerequisite: ENAE404 and ENAE441.

Mathematics and applications of orbit theory, building upon the foundations developed in ENAE 404 and ENAE 441. Topics include two body orbits, solutions of Kepler's equation, the two-point boundary value problem, rendezvous techniques, and Encke's method.

ENAE 602 Spacecraft Attitude Dynamics and Control (3 credits)

Prerequisite: ENAE404 and ENAE432.

Rigid body rotational dynamics of spacecraft; forced and unforced motion, torques produced by the orbital environment; orbit/attitude coupling; gas jet, momentum wheel, and magnetic torque actuators. Elementary feedback attitude regulators and algorithms for linear and nonlinear attitude tracking.

ENAE 631 Helicopter Aerodynamics I (3 credits)

Prerequisite: ENAE414 and ENAE311. Or permission of ENGR-Aerospace Engineering department; and permission of instructor.

A history of rotary-wing aircraft, introduction to hovering theory, hovering and axial flight performance, factors affecting hovering and vertical flight performance, autorotation in vertical descent, concepts of blade motion and control, aerodynamics of forward flight, forward flight performance, operational envelope, and introduction to rotor acoustics.

ENAE 632 Helicopter Aerodynamics II (3 credits)

Prerequisite: ENAE631; and (ENAE414 and ENAE311; or students who have taken courses with comparable content may contact the department). Or permission of ENGR-Aerospace Engineering department.

Basic aerodynamic design issues associated with main rotors and tail rotors, discussion of detailed aerodynamic characteristics of rotor airfoils, modeling of rotor airfoil characteristics, review of classical methods of modeling unsteady aerodynamics, the problem of dynamic stall, review of methods of rotor analysis, physical description and modeling of rotor vortical wakes, discussion of aerodynamic interactional phenomena on rotorcraft, advanced rotor tip design, physics and modeling of rotor acoustics.

ENAE 633 Helicopter Dynamics (3 credits)

Prerequisite: ENAE631. Or permission of ENGR-Aerospace Engineering department; and permission of instructor.

Flap dynamics. Mathematical methods to solve rotor dynamics problems. Flap-lag-torsion dynamics and identify structural and inertial coupling terms. Overview on rotary wing unsteady aerodynamics. Basic theory of blade aeroelastic stability and ground and air resonance stability, vibration analyses and suppression.

ENAE 634 Helicopter Design (3 credits)

Prerequisite: ENAE631. Or permission of ENGR-Aerospace Engineering department; and permission of instructor.

Principles and practice of the preliminary design of helicopters and similar rotary wing aircrafts. Design trend studies, configuration selection and sizing methods, performance and handling qualities analyses, structural concepts, vibration reduction and noise. Required independent design project conforming to a standard helicopter request for proposal (RFP).

ENAE 635 Helicopter Stability and Control (3 credits)

Prerequisite: ENAE631. Restriction: Permission of ENGR-Aerospace Engineering department.

Advanced dynamics as required to model rotorcraft for flight dynamic studies. Development of helicopter simulation models and specifications of handling qualities. Methods for calculation of trim, poles, frequency response, and free flight response to pilot inputs.

ENAE 640 Atmospheric Flight Mechanics (3 credits)

Prerequisite: ENAE403. Restriction: Permission of ENGR-Aerospace Engineering department.

Studies in the dynamics and control of flight vehicles. Fundamentals of the dynamics of rigid and non-rigid bodies and their motion under the influence of aerodynamic and gravitational forces.

ENAE 641 Linear System Dynamics (3 credits)

Prerequisite: ENAE432.

Linear systems; state space, multi-input, multi-output models; eigenstructure; controllability, observability, singular value analysis; multivariable Nyquist condition; observer design; introduction to Kalman filtering. Full state feedback techniques including pole placement and LQR/LQG techniques; introduction to loop shaping and robustness.

ENAE 642 Atmospheric Flight Control (3 credits)

Prerequisite: ENAE403 and ENAE432; or students who have taken courses with comparable content may contact the department.

Exposure to flight guidance and control. Draws heavily from vehicle dynamics as well as feedback theory, and careful treatment of the non-linear aspects of the problem is critical. Conventional sythesis techniques are stressed, although modern methods are not ignored. Multivariable system analysis is included, along with flight-control design objectives and hardware limitations. Emphasis on aircraft and missiles.

ENAE 646 Advanced Dynamics of Aerospace Systems (3 credits)

Prerequisite: ENAE301. Credit only granted for: ENAE788G or ENAE646. Formerly: ENAE788G.

Introduces the principles and methods for formulating and analyzing mathematical models of aerospace systems using Newtonian, Lagrangian, and Hamiltonian formulations of particle and rigid body dynamics. Additional topics include applied dynamical systems, geometric mechanics, and symmetry and reduction.

ENAE 651 Smart Structures (3 credits)

Topics related to the analysis, design, and implementation of smart structures and systems: modeling of beams and plates with induced strain actuation; shape memory alloys; electro-rheological fluids; magnetostrictor and electrostricter actuators and fiber optic sensors.

ENAE 652 Computational Structural Mechanics (3 credits)

Restriction: Permission of instructor; and permission of ENGR-Aerospace Engineering department. Credit only granted for: ENME 674, ENAE652, ENPM652 or ENPM808F.

Fundamentals of structural mechanics and computational modeling. Finite element modeling of two- and three-dimensional solids, plates and shells. Geometrically nonlinear behavior. Structural stability such as buckling and postbuckling.

ENAE 653 Nonlinear Finite Element Analysis of Continua (3 credits)
Prerequisite: ENAE652; or students who have taken courses with comparable content may contact the department.
Finite element formulation of nonlinear and time dependent processes. Introduction to tensors, nonlinear elasticity, plasticity and creep. Application to nonlinear solids including aerospace structures, such as shells undergoing finite rotations.

ENAE 654 Mechanics of Composite Structures (3 credits)
An introduction to structures composed of composite materials and their applications in aerospace. In particular, filamentary composite materials are studied. Material types and fabrication techniques, material properties, micromechanics, anisotropic elasticity, introduction to failure concepts.

ENAE 655 Structural Dynamics (3 credits)
Advanced principles of dynamics necessary for structural analysis; solutions of eigenvalue problems for discrete and continuous elastic systems, solutions to forced response boundary value problems by direct, modal, and transform methods.

ENAE 656 Aeroelasticity (3 credits)
Prerequisite: ENAE655. Restriction: Permission of ENGR-Aerospace Engineering department.
Topics in aeroelasticity: wing divergence; aileron reversal; flexibility effects on aircraft stability derivatives; wing, empennage and aircraft flutter; panel flutter; aircraft gust response; and aeroservoelasticity of airplanes.

ENAE 661 Advanced Propulsion I (3 credits)
Prerequisite: ENAE457 and ENAE455.
Special problems of thermodynamics and dynamics of aircraft power plants; jet, rocket and ramjet engines. Plasma, ion and nuclear propulsion for space vehicles.

ENAE 662 Advanced Propulsion II (3 credits)
Prerequisite: ENAE661.
Special problems of thermodynamics and dynamics of aircraft power plants; jet, rocket and ramjet engines. Plasma, ion and nuclear propulsion for space vehicles.

ENAE 663 Introduction to Plasmas for Space Propulsion and Power (3 credits)
Prerequisite: PHYS411; and permission of instructor. Credit only granted for: ENAE788L or ENAE663. Formerly: ENAE788L.
Characteristics of plasmas, motion of charged particles in fields, collisional processes, kinetic theory, fluid desctiption of plasmas, transpot properties, equilibrium vs. non-equilibrium, generation of plasmas.

ENAE 665 Advanced Airbreathing Propulsion (3 credits)
Prerequisite: ENAE674 and ENAE455; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor.
Advanced treatment of airbreathing propulsion technologies, propulsion system analysis, and engine/airframe integration. Topics will vary, but may include novel engine cycles, advanced gas turbine systems, pulsed systems, and high-speed engines, including scramjets and combined cycle systems.

ENAE 667 Advanced Space Propulsion and Power (3 credits)
Prerequisite: ENAE663. Restriction: Permission of instructor.
Advanced treatment of selected space propulsion and power technologies, methods of analysis and performance estimation. Topics will vary each year as time permits, but may include cold gas systems, chemical, nuclear, arcjets, beamed energy, and electric propulsion systems, as well as other advanced concepts.

ENAE 670 Fundamentals of Aerodynamics (3 credits)
Restriction: Permission of ENGR-Aerospace Engineering department.
Introduction to aerodynamics for aerospace engineering students specializing in fields other than aerodynamics. Broad coverage of flight regimes, inviscid theory, incompressible theory, subsonic compressible flow, linearized supersonic flow, hypersonic flow, viscous flows, Navier-Stokes equations, boundary layer theories.

ENAE 672 Unsteady and Inviscid Aerodynamics (3 credits)
Prerequisite: ENAE414; and permission of instructor.
Advanced fundamentals of unsteady and inviscid flows including complex potential, Euler's and Bernoulli's equations, transient flows, three-dimensional flows, vortex dynamics, and applications to wing theory.

ENAE 674 Aerodynamics of Compressible Fluids (3 credits)
Prerequisite: ENAE471. Restriction: Permission of ENGR-Aerospace Engineering department.
One-dimensional flow of a perfect compressible fluid. Shock waves. Two-dimensional linearized theory of compressible flow. Two-dimensional transonic and hypersonic flows. Exact solutions of two-dimensional isotropic flow. Linearized theory of three-dimensional potential flow. Exact solution of axially symmetrical potential flow. One-dimensional flow with friction and heat addition.

ENAE 676 Turbulence (3 credits)
Prerequisite: ENAE672. Recommended: ENAE674.
Physical and statistical descriptions of turbulence; review of phenomenological theories for turbulent flows; scales of motion; correlations and spectra; homogeneous turbulent flows; inhomogeneous shear flows; turbulent flows in pipes and channels; turbulent boundary layers; theory of methods for turbulent flows (Reynolds stress equations, LES, DES, DNS); experimental methods for turbulence measurements.

ENAE 681 Engineering Optimization (3 credits)
Restriction: Permission of ENGR-Aerospace Engineering department.
Methods for unconstrained and constrained minimization of functions of several variables. Sensitivity analysis for systems of algebraic equations, eigenvalue problems, and systems of ordinary differential equations. Methods for transformation of an optimization problem into a sequence of approximate problems. Optimum design sensitivity analysis.

ENAE 682 Hypersonic Aerodynamics (3 credits)
Restriction: Permission of ENGR-Aerospace Engineering department.
Hypersonic shock and expansion waves, Newtonian theory, Mach methods, numerical solutions to hypersonic inviscid flows, hypersonic boundary layer theory, viscous interactions, numerical solutions to hypersonic viscous flows. Applications to hypersonic vehicles.

ENAE 683 High Temperature Gas Dynamics (3 credits)
Restriction: Permission of ENGR-Aerospace Engineering department.
Aspects of physical chemistry and statistical thermodynamics necessary for the analysis of high temperature flows, equilibrium and nonequilibrium chemically reacting flows, shock waves, nozzle flows, viscous chemically reacting flow, blunt body flows, chemically reacting boundary layers, elements of radiative gas dynamics and applications to hypersonic vehicles.

ENAE 684 Computational Fluid Dynamics I (3 credits)
Restriction: Permission of ENGR-Aerospace Engineering department.
Partial differential equations applied to flow modelling, fundamental numerical techniques for the solution of these equations, elliptic, parabolic, and hyperbolic equations, elements of finite difference solutions, explicit and implicit techniques. Applications to fundamental flow problems.

ENAE 685 Computational Fluid Dynamics II (3 credits)
Prerequisite: ENAE684. Restriction: Permission of ENGR-Aerospace Engineering department.
Continuation of ENAE 684. Basic algorithms for the numerical solution of two and three dimensional inviscid and viscous flows. Applications to internal and external flow problems.

ENAE 688 Seminar (1-3 credits)

ENAE 691 Satellite Design (3 credits)
Prerequisite: ENAE483.
Systems design of Earth-orbiting satellites, including geostationary communications satellites and low Earth orbit constellations. Basics of orbital motion, communications, and instrument design. Spacecraft systems, structural design, thermal design, power generation, and attitude determination and control. Launch vehicle interfacing and mission operations.

ENAE 692 Introduction to Space Robotics (3 credits)
Analysis techniques for manipulator kinematics and dynamics. DH parameters, serial and parallel manipulators, approaches to redundancy. Applications of robots to space operations, including manipulators on free-flying bases, satellite servicing, and planetary surface mobility. Sensors, actuators, and mechanism design. Command and control with humans in the loop.

ENAE 694 Spacecraft Communications (3 credits)
Brief overview of satellite orbits. Radio frequency communications, noise, and bandwidth limitations. Link budget analysis. Modulation and multiplexing approaches, multiple access systems. Satellite transponder and Earth station technology.

ENAE 696 Spacecraft Thermal Design (3 credits)
Thermal sources in space. Black-body radiation; absorptivity and emissivity; radiative thermal equilibrium. Mutually radiating plates, view angles, and interior conduction. Techniques of spacecraft thermal analysis; approaches to passive and active thermal control.

ENAE 697 Space Human Factors and Life Support (3 credits)
Engineering requirements supporting humans in space. Life support design: radiation effects and mitigation strategies; requirements for atmosphere; water, food, and temperature control. Accommodations for human productivity in space: physical and psychological requirements; work station design; and safety implication of system architectures. Design and operations for extra-vehicular activity.

ENAE 741 Interplanetary Navigation and Guidance (3 credits)
Prerequisite: ENAE601 and ENAE432.
Interplanetary trajectory construction; patched and multiconic techniques. Methods of orbit and attitude determination; applied Kalman filtering. Guidance algorithms and B-plane targeting. Interplanetary navigation utilizing in situ and radio techniques.

ENAE 742 Robust Multivariable Control (3 credits)
Limitations on achievable performance in multivariable feedback systems due to uncertainty. Singular values, matrix norms, multivariable Nyquist stability theory, uncertainty modeling in aerospace systems. Loop-shaping, generalization of Bode design principles. Characterizing the uncertainty, robustness and performance analysis, and synthesis, primarily in the frequency domain. Current research directions. Aerospace examples are used to complement the theory.

ENAE 743 Applied Nonlinear Control of Aerospace Vehicles (3 credits)
Prerequisite: ENAE641.
Modern methods of analysis and synthesis of multivariable nonlinear control techniques for aircraft, spacecraft, and space manipulator systems. Topics include passivity and Lyapunov theory, feedback linearization, nonlinear observers, Hamiltonian methods, robust controller design, and an introduction to adaptive nonlinear control methods.

ENAE 757 Advanced Structural Dynamics (3 credits)
Prerequisite: ENAE655; or students who have taken courses with comparable content may contact the department.
Demonstrate the practical application of Smart Materials and Spatially Distributed Transducers to the design and control of advanced structures. The course will be focused toward the active control of continuum structures using advance Spatially Distributed Parameter System control techniques and concepts. Effective system parameterizations will be used to reduce distributed parameter system models to classical canonical state space form for the purpose of robust adaptive structure design. Application case studies, including morphing structures will be employed as necessary to enhance the students intuition and understanding of Distributed Parameter Systems.

ENAE 788 Selected Topics in Aerospace Engineering (1-3 credits)

ENAE 791 Launch and Entry Vehicle Design (3 credits)
Prerequisite: ENAE601.
Design of aerospace vehicles for atmospheric transit to and from space. Generic formulation of atmospheric flight dynamics. Ballistic and lifting entry trajectories. Estimation of vehicle aerodynamic properties and aerothermodynamic heating. Entry thermal protection design. Trajectory analysis of sounding rockets and orbital launch vehicles. Serial, parallel, and hybrid multistaging schemes, optimal multistaging. Constrained trajectory optimization. Launch vehicle economic and reliability analysis, flight termination systems, sensors and actuators.

ENAE 799 Master's Thesis Research (1-6 credits)

ENAE 898 Pre-Candidacy Research (1-8 credits)

ENAE 899 Doctoral Dissertation Research (1-8 credits)

Engineering, Civil (ENCE)

ENCE 402 Simulation and Design of Experiments for Engineers (3 credits)
Prerequisite: ENCE302; and permission of ENGR-Civil & Environmental Engineering department.
Review of statistics and hypothesis testing, sample design and design of experiments, generation of discrete and continuous distributions and their applications. Introduction of simulation languages and simulation of discrete and continuous engineering systems. Output analysis, model validation and sensitivity and reliability analysis.

ENCE 411 Environmental Engineering Science (3 credits)
Prerequisite: ENCE310; and permission of ENGR-Civil & Environmental Engineering department.
Introduces the analytical techniques available to assess performance of engineering processes as they relate to water, soil, and air treatment and quality. The basic principles of environmental management, economics of waste

treatment, by-product reutilization, and energy cycles are introduced and discussed. Alternative technologies are introduced and evaluated mostly by assessing their potential to reduce waste, minimize energy use, and promote sustainability. Students' activities include, a weekly lab to provide hands-on experience with environmental quality measurements and treatment techniques; on-site visits to regional industries that undertake sustainable practices; and a final research project where experimental design and laboratory techniques are used to assess interactions between technologies and natural systems and their potential for reducing environmental impacts.

ENCE 412 Environmental Engineering Unit Operations (3 credits)

Prerequisite: ENCE305 and ENCE310; and permission of ENGR-Civil & Environmental Engineering department.

Examination of unit operations and processes encountered in environmental engineering field. Fundamental principles learned from previous classes will be applied into the design and operation of unit operations and processes, particularly in the area of water and wastewater treatment. Similar processes will be applied to air pollution control, solid waste disposal and hazardous waste treatment.

ENCE 420 Selection and Utilization of Construction Equipment (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or must be in the Construction Project Management minor.

Learn to evaluate and select construction equipment with a focus on mechanized equipment for earthwork and building construction.Learn about the parties involved in procurement, operation and maintenance, and how to cost-effectively plan, select, and utilize equipment for earthmoving, paving, formwork, trenching, rock excavation, tunneling, site preparation, and steel and concrete construction. Explore trends in equipment design, construction automation, and robotics.

ENCE 421 Legal Aspects of Architectural and Engineering Practice (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or must be in the Construction Project Management minor; or must be in the Project Management Minor.

Learn the basic structure of the US legal system and court procedures and legal principles relevant to architectural and engineering design and construction contracts including principles of ethical, legal and professional conduct of engineers and architects.Topics include: contracts for design and construction, sales and warranties, torts and product liability, business agency and government agencies, professional liability of architects and engineers, labor laws, expert testimony, mediation and arbitration, tangible property including real estate, intellectual property including trademarks, patents and copyrights, insurance and sureties.

ENCE 422 Project Cost Accounting and Economics (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or must be in the Construction Project Management Minor; or must be in the Project Management Minor.

Learn: the fundamentals of accounting; project cost accounting principles as they apply to project management; project cost accounting; and the fundamentals of engineering economics.Topics include: project feasibility analysis; reading and analyzing financial statements; cash management; cash flow analysis; depreciation and taxes; and impact on profitability; the principles of activity based costing; net present value analysis; the framework for project performance measurement, cost performance indices, and earned value analysis.

ENCE 423 Project Planning, Estimating & Scheduling (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or must be in the Construction Project Management Minor; or must be in the Project Management Minor.

Learn the fundamentals of project planning, estimating, and scheduling. Understand the concepts of planning; to reduce uncertainty, improve efficiency of the operation, to set and meet objectives, and to provide a basis for monitoring and controlling the work. Be introduced to: the concepts of resource definition, assignment and management, and; the basics of project estimating (pricing) methods including global pricing strategies, types of estimates, pricing processes, overhead and profit, and project financing.Learn the basics of project scheduling including; bar charts, network-based methodologies, and linear scheduling techniques. Emphasis is placed on Critical Path Method (CPM) scheduling, a network based methodology. Be exposed to the use of scheduling software and will actually develop a CPM schedule for an actual construction project as part of a semester project.

ENCE 424 Communication for Project Managers (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or must be in the Construction Project Management Minor; or must be in the Project Management Minor.

Learn the fundamentals of communications for project managers. Emphasis is on interpersonal and group communications; through voice, electronic, and written messages; project cycle and reports and presentations during this cycle; and communications for employment.

ENCE 426 Construction Documentation and BIM Applications in Engineering and Construction (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or must be in the Construction Project Management Minor; or must be in the Project Management Minor.

Learn the basics of construction documentation methods, with particular emphasis on Building Information Modeling (BIM). Topics include: the fundamentals of assembly, coordination, and maintenance of construction documents and implementation of BIM techniques in the design and construction processes, and; a review of Autodesk, Revit, and Navisworks and other leading BIM software. Lectures from project management faculty supplemented by guest lecturers from the construction industry.

ENCE 431 Hydrologic Engineering (3 credits)

Prerequisite: ENCE305; and permission of ENGR-Civil & Environmental Engineering department.

An introduction to basic principles of hydrologic science including the hydrologic cycle, rainfall, surface runoff and streamflow. Special emphasis is placed on hydrologic engineering design of stormwater management and flood control facilities. Design projects are used to illustrate design practices.

ENCE 432 Ground Water Hydrology (3 credits)

Prerequisite: ENCE305; and permission of ENGR-Civil & Environmental Engineering department.

Concepts related to the development of the ground water resources, hydrology, hydrodynamics of flow through porous

media, hydraulics of wells and basin-wide ground water development. Fundamentals of ground water pollution are introduced.

ENCE 441 Foundation Design (3 credits)
Prerequisite: ENCE340; and permission of ENGR-Civil & Environmental Engineering department.
Critical review of classical lateral earth pressure theories, analysis of retaining walls and reinforced earth walls, subsurface explorations, bearing capacity and settlement of shallow foundations, design of deep foundations that includes both pile foundations and drilled shafts.

ENCE 444 Experimental Methods in Geotechnical Structural Engineering (3 credits)
Prerequisite: ENCE353 and ENCE340; and permission of ENGR-Civil & Environmental Engineering department.
In the geotechnical engineering part of the course, major soils testing and their interpretation including classification, compaction, strength, and compressibility will be undertaken. The structural engineering part of this course covers test planning, loading apparatus, instrumentation, data acquisition and data analysis, as well as basic aspects of structural testing techniques and shake-table test.

ENCE 447 Pavement Engineering (3 credits)
Prerequisite: ENCE340; and permission of ENGR-Civil & Environmental Engineering department.
Fundamental principles underlying the design, construction, maintenance and repair, and management of highway and airfield pavement systems. Pavement performance (functional/structural; evaluation); pavement mechanics (multi-layered elastic theory; slab theory); pavement materials (properties and characterization); environmental effects; current rigid and flexible design methods (new/rehabilitation); construction (new construction; maintenance/repair; rehabilitation); economic evaluation; pavement management.

ENCE 453 Computer-Aided Structural Analysis (3 credits)
Prerequisite: ENCE353; and permission of ENGR-Civil & Environmental Engineering department.
Computer-aided analysis of structural systems. Unified matrix formulation of stiffness and flexibility methods. Slope deflection method. Evaluation of truss, frame, and grid systems. Non-prismatic and curved elements. Error analysis and determination of ill-conditions. Introduction to finite element methods; formulation of simple two-dimensional elements. In laboratory, use and development of CAD software.

ENCE 454 Design of Concrete Structures (3 credits)
Prerequisite: ENCE353; and permission of ENGR-Civil & Environmental Engineering department. Formerly: ENCE451.
Combined bending and compression, development and anchorage of reinforcement, deflections, design of slabs including one-way and two-way, design of footings, retaining walls, introduction to prestressed concrete, design of multi-story buildings.

ENCE 455 Design of Steel Structures (3 credits)
Prerequisite: ENCE353; and permission of ENGR-Civil & Environmental Engineering department.
Behavior and design of members subjected to fatigue, and combined bending and compression; plate girders, composite beams, open-web joists and connections. Methods of allowable stress design, and load and resistance factor design. Elements of plastic analysis and design. Framing systems and loads for industrial buildings and bridges.

ENCE 466 Design of Civil Engineering Systems (3 credits)
Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Senior standing. Additional information: Must be taken in the semester in which the student graduates.
A major civil engineering design experience that emphasizes development of student creativity, development and use of design methodologies, evaluation of alternate solutions, feasibility considerations, and detailed system descriptions. Realistic design constraints including economic factors, safety, aesthetics, and reliability will be imposed. Students will work in design project groups and be required to exercise oral and written communication skills.

ENCE 470 Highway Engineering (3 credits)
Prerequisite: ENCE302 and ENCE370; and permission of ENGR-Civil & Environmental Engineering department.
Highway location and design, highway engineering economics, traffic engineering, traffic measurement devices and technologies. Includes discussion of technological advances in traffic flow and capacity, such as signal systems, corridor control, automatic driver information, incident detection and autonomous vehicle operation.

ENCE 472 Transportation Engineering (3 credits)
Prerequisite: ENCE302 and ENCE370; and permission of ENGR-Civil & Environmental Engineering department.
Transportation engineering concepts including transportation systems analysis, airport systems, airline and airport operations, marine transportation and urban public transportation systems.

ENCE 488 Senior Thesis (3 credits)
Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Senior standing.
Advanced study in civil engineering problems with special emphasis on mathematical modeling and experimental methods.

ENCE 489 Special Problems in Civil Engineering (1-4 credits)
Prerequisite: Permission of ENGR-Civil & Environmental Engineering department. Restriction: Senior standing.
A course arranged to meet the needs of exceptionally well prepared students for study in a particular field of civil engineering.

ENCE 600 The Project Management Office: Execution Across Boundaries (3 credits)
Prerequisite: ENCE662. Restriction: Must be in one of the following programs (ENGR: MS/PhD-Civil Engineering (Master's); ENGR: MS/PhD-Civil Engineering (Doctoral); Master of Engineering (Master's)) ; or permission of ENGR-Civil & Environmental Engineering department.
This course begins with a review of the project's cultural environment in order to understand the context of executing projects globally. Emphasis will be on the project office's role in stakeholders' engagement in the planning and execution aspects of projects. The coursewill also highlight the role of the project office in the virtual and agile management of project delivery; the fundamentals of communicating across different cultural boundaries; and the importance of matrixed business alliances.

ENCE 601 Program and Portfolio Management (3 credits)
Restriction: Must be in one of the following programs (ENGR: MS/PhD-Civil Engineering (Master's); Master of Engineering-Project Mgmt (Master's); ENGR: MS/PhD-Civil Engineering (Doctoral); Master of Engineering (Master's)) ; or permission of ENGR-Civil & Environmental Engineering department. Credit only granted for:

ENCE601 or ENCE688F. Formerly: ENCE688F.
A view of managing projects from an organizational perspective will be presented. The principle areas of discussion will be strategic alignment, marshalling organizational assets through an enterprise project office, portfolio management, and program management. Using a case study approach, students will explore the importance of using organizational strategies to align projects, how to use an enterprise project office as a governance process, and apply practices to create portfolios and programs to leverage organizational assets. Principle topics will include establishing a governance process, project selection techniques, project portfolio methodology, and application of project practices to program management.

ENCE 602 Project Procurement Management (3 credits)

Fundamental concepts and techniques for project acquisition and procurement are presented. Students are introduced to the PMBOK Guide six-step procurement process and expected to develop an in-depth understanding of project evaluation, planning, financing, contracting, negotiation, and procurement execution. It will also cover emerging methods, principles, and practices in infrastructure project procurement, including Public-Private Partnerships, Carbon project procurement, and Clean Development Mechanism.

ENCE 603 Management Science Applications in Engineering (3 credits)

Prerequisite: (ENCE302; or (ENME271 and ENME392)); and (MATH140 and MATH240). Or permission of instructor. Also offered as: ENCE603. Credit only granted for: ENME738, ENME741, or ENCE603. Formerly: ENME738.
The fundamentals of Management Science techniques in Project Management including: linear and integer programming, goal programming, multi-objective optimization, simulation, Analytic Hierarchy Process (AHP), deterministic and stochastic dynamic programming will be covered. Applications will be drawn from the Critical Path Method (CPM), resource management, and other areas of Project management.

ENCE 604 Sustainabilty Fundamentals for Project Managers (3 credits)

Addresses the fundamentals of sustainability for project managers including best practices of modern sustainable construction and project management. Commercial and residential buildings consume about 40 percent of the energy used in the United States. Therefore, emphasis will be on the application of the sustainable development standards to the built environment, including the practical operational aspects of sustainable facility project management.

ENCE 605 Evolving as a Project leader (3 credits)

Prerequisite: ENCE665.
Projects are now used by many organizations for the implementation of strategic initiatives. This means that project managers must be able to do more than manage, organize, and control. They must be able to lead the project team and its stakeholders through change. This course builds on the foundation created in ENCE665. It explores: (1)leadership theory and evolution; (2) the role of leadership in project teams; (3) you as a leader; and (4) your personal development as a project leader.

ENCE 606 Graduate Introduction to Project Scheduling (3 credits)

Students are taught the basics of project scheduling and the various scheduling approaches that are currently being used in the design and construction industry. Project planning techniques will be covered and basic scheduling methods will be taught including the use of bar charts. Critical Path Method (CPM), Program Evaluation and Review (PERT) and Linear Scheduling (Line of Balance) methods.

ENCE 607 Real Estate Investment and Planning for the Project Manager (3 credits)

Real estate investment and development is fundamentally the acquisiton, financing, construction, leasing, and disposition of land and buildings. While many courses examine the traditional elements of project management, few courses prepare students for the complex interaction of property acquisition, financing, design, and construction. To succeed and be valued by owners, the project manager must recognize the mechanics and perils of real estate investment and communicate in the language of development.

ENCE 610 Fundamentals of Structural Analysis (3 credits)

Cartesian tensor notation. Linear forms of the general equilibrium, compatability, and constitutive equations. The calculus of variations. The principles of virtual work and complementary virtual work. Self-adjoint problem formulations.

ENCE 611 Finite Element Methods (3 credits)

Formerly: ENCE661.
Basic principles and fundamental concepts of the finite element method. Consideration of geometric and material nonlinearities, convergence, mesh gradation and computational procedures in analysis. Applications to plane stress and plane strain, plates and shells, eigenvalue problems, axisymmetric stress analysis, and other problems in civil engineering.

ENCE 613 Structural Dynamics (3 credits)

Formerly: ENCE653.
Analysis of the dynamic response of structrues and structural components subjected to impact load, transient load, and ground excitations; study of single degree-of-freedom and multi degree-of-freedom systems in classical closed form solution and approximate numerical solution; solution in the frequency domain and the use of finite element method.

ENCE 615 Structural Reliability (3 credits)

Probability and statistics. Fundamentals of uncertainty analysis. Fundamentals of structural reliability. Reliability-based design. Simulation and variance reduction techniques. Fuzzy sets and applications.

ENCE 616 Plates and Shells (3 credits)

Formerly: ENCE652.
Medium thick plate theory, Von-Karman's plate theory, orthotropic plates; approximate methods; buckling; membrane theory of shells, bending theory of shells and shell deformations.

ENCE 620 Risk Analysis for Engineering (3 credits)

Sources of hazards, definition of risk, system analysis, functional modeling and analysis techniques, probabilistic risk assessment procedure, risk methods, risk acceptance, assessment of failure likelihood, consequence assessment, risk benefit assessment, uncertainty surces and types, modeling uncertainty, risk analysis and decision making under uncertainty, collection of data, expert-opinion elicitation, human-machine interface and human factors engineering.

ENCE 621 Uncertainty Modeling and Analysis (3 credits)

Prerequisite: ENCE302; or students who have taken courses with comparable content may contact the department.
Definition of engineering systems, knowledge levels using information science concepts as applied to engineering systems, sources and types of knowledge and ignorance, uncertainty sources and types for engineering systems, probability models, statistical models, fuzziness, fuzzy sets, fuzzy logic, fuzzy arithmetic, imprecise probabilities, evidence methods, uncertainty measures, uncertainty management, uncertainty reduction, applications of these analytical methods to engineering systems and in decision making.

ENCE 623 Introduction to Advanced Scheduling (3 credits)

Prerequisite: ENCE423 or ENCE662; and permission of ENGR-Civil & Environmental Engineering department. Credit only granted for: ENCE623 or ENCE688S.
A Combination of lecture and hands-on use of software to develop advanced knowledge and skills necessary to master advanced scheduling techniques for project management and control will be used. No software purchase is necessary.

ENCE 624 Managing Projects in a Dynamic Environment (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department.
This course examines the nine principles simultaneous managers use interdependently and presents a theory of project management that is intellectually rigorous and consistent with pragmatic knowledge.

ENCE 625 Project Administration (3 credits)

The principles of project administration procedures from the viewpoint of a resident project manager or project engineer specifically addressing their responsibilities in the engineering, design, or construction industries are examined. The course is suitable for students, engineering and design professionals, project managers, experienced contract administrators, and owners interested in the special administrative problems of construction.

ENCE 626 Web-based Project Management (3 credits)

Prerequisite: ENCE662.
The use of IT tools, in particular the Web, is increasingly becoming the primary instrument for conducting the day-to-day tasks of engineering project management. Traditional client-server based technologies and applications can now be replaced by a web-centric, collaborative, electronic workplace. This course examines the use of Internet and Intranet based project management in the context of collaboration, decision making and information exchange, and presents a systematic understanding of the principle issues in Web based tools- ease of use, efficient decision making, and cost effectiveness. The course will use project case histories as part of a team project.

ENCE 627 Project Risk Management (3 credits)

Restriction: Must not have completed ENCE627.
Introduction to identifying, analyzing, assessing, and managing risks inherent to engineering projects. Includes: probability modeling, choice and value theory, schedule and cost risk, risk mitigation and transfer, and contract considerations of project risk. Examples are drawn from construction, software development, systems integration, and other large engineering projects; and cover probability basics, subjective probability, statistical data analysis, introduction to decision theory, Monte Carlo simulation, value of information, and risk-based decision making.

ENCE 630 Environmental and Water Resource Systems I (3 credits)

Application of statistical and systems engineering techniques in the analysis of information necessary for the design or characterization of environmental or hydrologic processes; emphasis on the fundamental considerations that control the design of information collection programs, data interpretation, and the evolution of simulation models used to support the decision-making process.

ENCE 631 Hydrologic Analysis and Nonpoint Pollution Models (3 credits)

A detailed analysis of the physical processes controlling the spatial distribution of runoff and constituent transport during rainfall and snowmelt events. Emphasis is on developing an understanding of the processes and translating this understanding into practical models that can be used for runoff simulation, stormwater management, and environmental impact assessment.

ENCE 635 Geographic Information Systems for Watershed Analysis (3 credits)

Credit only granted for: ENCE524 or ENCE688Z. Formerly: ENCE688Z.
Emphasis is on the use of GIS to support the analysis and modeling tasks associated with watershed planning and management. This course familiarizes the student with fundamentals of GIS data models, projections, and coordinate systems. Students develop a set of GIS-based alogrithms solving common engineering problems in hydrology. Internet data sources and GPS technology are also covered.

ENCE 637 Biological Principles of Environmental Engineering (3 credits)

An examination of biological principles directly affecting man and his environment, with particular emphasis on microbiological interactions in environmental engineering related to air, water and land systems; microbiology and biochemistry of aerobic and anaerobic treatment processes for aqueous wastes.

ENCE 640 Advanced Soil Mechanics (3 credits)

Prerequisite: ENCE340; or students who have taken courses with comparable content may contact the department.
Introduction to the use of elastic theory in stress and displacement solutions to geotechnical engineering (soil and rock mechanics). The effect of soil moisture (at rest) relative to effective stress principles, capillary and frost. Exact and numeric techniques for the analysis for soil seepage under isotropic and anisotropic conditions. Classical settlement (consolidation) and compressiblility theories, including finite difference solution for vertical and radial drainage.

ENCE 641 Advanced Foundations Systems (3 credits)

Prerequisite: ENCE340; or students who have taken courses with comparable content may contact the department.
Review of soil properties and subsurface exploration, evaluation and design of shallow foundations, including settlement and bearing capacity of spread footings and mats. Discussion of methods of soil improvement. Analysis and design of deep foundations including single pile, pile load testing, pile group actions, and drilled shaft foundations for both vertical and horizontal loads. Load and resistance factor design concepts will be presented.

ENCE 644 Advanced Pavement and Civil Engineering Materials (3 credits)

Prerequisite: ENCE300. Credit only granted for: ENCE644 or ENCE688P. Formerly: ENCE688P.
Advanced course in Highway and Civil Engineering Materials. Dynamic Material Characterization. Elastic, Plastic and Viscoelastic Behavior. Energy Analysis. Physical and Mechanical Properties. NDT. Performance: Creep, Fatigue, Durability, other. Recent developments in Aggregate Evaluation, Portland Cement Concrete, High Performance Concrete, Conventional and Modified Asphalt Binders and Mixtures, Polymers & Composites, Geotextiles, Smart and Self Healing Materials, Recycled and Reclaimed Materials.

ENCE 645 Geotechnics of Waste Disposal (3 credits)

Credit only granted for: ENCE489X, ENCE645, or ENCE688X. Formerly: ENCE688X.
Fundamental aspects of geotechnical engineering that apply to problems of waste containment and remediation, basic principles of containment systems, compacted clay liners and clay mineralogy, hydraulic conductivity of compacted soils, methods of laboratory and field hydraulic conductivity measurements, design of waste containment systems, landfill stability and settlement, geosynthetic liners, waste compatibility, contaminant transport through liners, leachate collection systems, gas collection systems, covers and caps.

ENCE 647 Slope Stability and Seepage (3 credits)

Prerequisite: ENCE340. Credit only granted for: ENCE489A, ENCE647, or ENCE688A. Formerly: ENCE688A.
Theoretical and practical aspects of seepage effects, and groundwater flow, review of shear strength principles, flow through porous media, hydraulic conductivity, flow nets, determination of water pressure, seepage forces and quantity of seepage, laboratory and field tests for shear strength, infinite slopes, block analysis, method of slices, seismic analysis of slopes, effective and total stress analysis, computer program for slope stability analysis, slope stability problems in waste disposal, construction excavations, reinforced embankments, embankments on soft ground.

ENCE 650 Process Dynamics in Environmental Systems (3 credits)

Formerly: ENCE636.
The fundamentals of heterogeneous equilibria, rates of environmental reactions, and flow and material transport or presented. Applications of these principles will be presented to small and large scale environmental problems involving liquid, gas, and solid phases. Both natural and engineered environmental systems will be examined.

ENCE 651 Chemistry of Natural Waters (3 credits)

Credit only granted for: ENCE633 or ENCE651. Formerly: ENCE633.
Application of principles from chemical thermodynamics and kinetics to the study and interpretation of the chemical composition of natural waters is rationalized by considering metal ion solubility controls, pH, carbonate equilibria, adsorption reactions, redox reactions and the kinetics of oxygenation reactions which occur in natural water environments.

ENCE 655 Environmental Behavior of Organic Pollutants (3 credits)

Prerequisite: ENCE651.
Introduction to the scientific data needed and methods currently available to assess the environmental risk of organic chemicals. Applications of principles from chemical thermodynamics will be used to study phase-transfer processes of organic pollutants in the environment (solid/water, solid/air, water/air). Physical-chemical properties of organic pollutants will be used to estimate partitioning.

ENCE 661 Project Cost Accounting and Finance (3 credits)

This course reviews the fundamentals of accounting; examines project cost accounting principles, applications, and impact on profitability; examines the principles of activity based costing; covers the elements involved in cash management; introduces the framework for how projects are financed and the potential impact financing has on the projects; and a framework for evaluating PC based systems and what resources are needed for an effective project cost system.

ENCE 662 Introduction to Project Management (3 credits)

Introduction to project management including: overview and concepts of project management (principles, body of knowledge, strategies); planning successful projects (defining, specifying, delivery options, scheduling, budgeting); implementing (organizing the team, work assignments, team building, effective leadership); executing (performance measurement, maintaining the schedule, adjustments/mid-course corrections, record keeping, status reporting, communications, managing conflict, time management); and closeout(performance measurement, maintaining the schedule, adjustments/mid-course corrections, record keeping, status reporting, communications, managing conflict, time management).

ENCE 663 Management of Design and Construction Organizations (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department.
This course examines the management focus of the design and/or construction company and how corporate management is different from, yet relates to, and impacts project management. The company creates the framework within which projects may consistently achieve excellent performance or they may struggle to complete behind schedule, over budget, and not meet the customer's requirements. What makes the difference?

ENCE 664 Legal Aspects of Engineering Design and Construction (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department.
Examines ways in which the legal system affects the design and construction process. Focuses on contract types and the relationships between the parties in different delivery systems. Covers basics of procurement protocols along with negotiating techniques and strategies. Topics include contract law, the relationships between the parties, tort and negligence law, and the statutory principles affecting construction.

ENCE 665 Management of Project Teams (3 credits)

Experience has shown that really excellent project managers are not only technically competent but that they have above average skills in human relations and communications. The course will prepare project managers to optimize the utilization of their most important resource: people. Relying primarily on a wide range of research and experience in the Project Team, this course will help guide project managers in building the other skills needed to be truly successful in the competitive Project Team.

ENCE 666 Cost Engineering and Control (3 credits)

Analytic techniques to estimate and control project costs, including site investigation, quantity takeoff, work analysis and bid preparation. Systematic cost control as related to job production and historical data.

ENCE 667 Project Performance Measurement (3 credits)

Prerequisite: Permission of ENGR-Civil & Environmental Engineering department.
Examination of various techniques and models used to measure the performance of projects. Topics will include: Critical Path Method (CPM), Program Evaluation Review Technique (PERT), Gantt charts, project crashing, resource management, capital allocation, forecasting, hypothesis testing, regression analysis, learning curve analysis, goal programming, Monte Carlo simulation, the Analytic Hierarchy Process (AHP), Pareto optimality and tradeoff curves as well as basics in linear programming and uncertainity modeling.

ENCE 670 Highway Traffic Characteristics and Measurements (3 credits)

Prerequisite: ENCE470; or permission of instructor.
The study of the fundamental traits and behavior patterns of road users and their vehicles in traffic. The basic characteristics of the pedestrian, the driver, the vehicle, traffic volume and speed, stream flow and intersection operation, parking, and accidents.

ENCE 672 Regional Transportation Planning (3 credits)

Factors involved and the components of the process for planning statewide and regional transportation systems, encompassing all modes. Transportation planning studies, statewide traffic models, investment models, programming and scheduling.

ENCE 673 Urban Transportation (3 credits)

The contempory methodology of urban transportation planning. The urban transportation planning process, interdependence between the urban transportation system and the activity system, urban travel demand models, evaluation of urban transportation alternatives and their implementation.

ENCE 674 Urban Transit Planning and Rail Transportation Engineering (3

credits)
Basic engineering components of conventional and high speed railroads and of air cushion and other high speed new technology. The study of urban rail and bus transit. The characteristics of the vehicle, the supporting way, and the terminal requirements will be evaluated with respect to system performance, capacity, cost, and level of service.

ENCE 675 Airport Planning and Design (3 credits)
The planning and design of airports including site selection, runway configuration, geometric and structural design of the landing area, and terminal facilities. Methods of financing airports, estimates of aeronautical demand, air traffic control, and airport lighting are also studied.

ENCE 676 Highway Traffic Flow Theory (3 credits)
An examination of physical and statistical laws that are used to represent traffic flow phenomena. Deterministic models including heat flow, fluid flow, and energy-momentum analogies, car following models, and acceleration noise. Stochastic approaches using independent and Markov processes, Queuing models, and probability distributions.

ENCE 677 OR Models for Transportation Systems Analysis (3 credits)
Fundamental skills and concepts of the quantitative techniques of operations research including: mathematical modeling, linear programming, integer programming, network optimization (shortest paths, minimum spanning trees, minimum cost network flows, maximum flows), heuristics, and basics of probabilistic modeling. Emphasis on the application of these techniques to problems arising in transportation.

ENCE 681 Freight Transportation Analysis (3 credits)
Application of operations research and system analysis methods to freight transportation systems. Cost and output analysis, terminal location, freight transportation demand models, freight transportation network equilibrium models and analytic models for analyzing the operations of rail, motor carrier, water carrier and air cargo systems.

ENCE 688 Advanced Topics in Civil Engineering (1-3 credits)
Advanced topics selected by the faculty from the current literature of civil engineering to suit the needs and background of students. May be taken for repeated credit when identified by topic title.

ENCE 689 Seminar (1-16 credits)

ENCE 710 Steel Structures I (3 credits)
Formerly: ENCE656.
Moment connections of beams and columns. Wind bracing connections. Plate girders. Floor systems for buildings. Strengthening of beams and trusses. Corrosion control. Fatigue and fracture.

ENCE 713 Concrete Structures I (3 credits)
Formerly: ENCE753.
The behavior and strength of reinforced concrete members under combined loadings, including the effects of creep, shrinkage and temperature. Mechanisms of shear resistance and design procedures for bond, shear and diagonal tension. Elastic and ultimate strength analysis and design of slabs. Columns in multistory frames. Applications to reinforced concrete structures.

ENCE 715 Earthquake Engineering (3 credits)
Restriction: Permission of instructor.
Formerly: ENCE755.
Review of SDOF and MDOF structural dynamics; characteristics of earthquakes; philosophies of seismic design; elastic and inelastic response spectra; design for ductility; principles of capacity design; design of structural systems requiring special performance criteria.

ENCE 717 Bridge Structures (3 credits)
Formerly: ENCE751.
The design and rating of bridge structures in accordance with the AASHTO WSD, LFD, ALFD, and LRFD specifications. Development of the basic strength and performance requirements as defined within AASHTO, area and various foreign codes. Projects requiring the design, rating and ultimate strength evaluations will be assigned for all of the predominate construction types including: simple and continuous span, straight and horizontally curved, non-composite and composite w and box section superstructure elements.

ENCE 718 Advanced Structural Systems (3 credits)
Formerly: ENCE750.
Review of classical determinate and indeterminate analysis technique; multistory buildings; space structures; suspension bridges and cables structures; arches; long span bridges.

ENCE 721 Investment Theory for Project Engineers (3 credits)
Credit only granted for: ENCE652 or ENCE721. Formerly: ENCE652.
An introductory course covering investment theory and its application to project evaluation and selection. Selected topics include: basic theory of interest and fixed income securities; portfolio selection and modification; capital asset pricing; asset price dynamics; derivative securities; and project evaluation using real options.

ENCE 722 Market, Spatial, and Traffic Equilibrium Models in Project Management (3 credits)
Credit only granted for: ENCE654, ENCE688M, or ENCE722. Formerly: ENCE654.
Introduction to equilibrium models involving economics and engineering. Topics include: review of relevent optimization theory; the nonlinear complementary problem (NCP) and variational inequality problem formats to solve equilibrium problems; review of relevant game theory, equilibrium models, and algorithims.

ENCE 725 Probabilistic Optimization (3 credits)
Also offered as: ENME725. Credit only granted for: ENME725 or ENCE725.
Provide an introduction to optimization under uncertainty. Chance-constrained programming, reliability programming, value of information, two stage problems with recourse, decomposition methods, nonlinear and linear programming theory, probability theory. The objectives of this course are to provide understanding for studying problems that involve optimization under uncertainty, learn about various stochastic programming formulations (chance constrained programs, two stage methods with recourse, etc.) relevant to engineering and economic settings, present theory for solutions to such problems, and present algorithms to solve these problems.

ENCE 730 Environmental and Water Resource Systems II (3 credits)
Prerequisite: ENCE630; or permission of instructor.
Advanced topics in operational research. Applications to complex environmental and water resource systems. The use of systems simulation and probabalistic modeling.

ENCE 740 Computational Geomechanics (3 credits)
Recommended: Must have previous coursework on finite element theory (e.g. ENCE611). Credit only granted for: ENCE688X or ENCE740. Formerly: ENCE688X.
Focus on the application of computational mechanics, and in particular the finite element method, on the solution of stress and flow problems in geomechanics. Review of theoretical formulation of the finite element method, with particular emphasis on the special features most useful in geomechanics. Thorough treatment of the issues involved in performing robust practical analyses of real-world problems. Course term project enables students to apply these techniques to a geomechanics problem of their choosing.

ENCE 741 Earth Retaining Structures (3 credits)
Introduction to types and uses of earth retaining structures, and lateral earth pressure concepts and theories. Analysis and design of retaining walls and shoring structures and their bracing systems. These include conventional retaining walls, mechanically stabilized earth walls, cantilever and anchored sheet piling, cellular cofferdams, braced cuts, soil nailing, and the design of tiebacks and anchors. Load and resistance factor design concept will be presented.

ENCE 743 Soil Dynamics and Earthquake Engineering (3 credits)
Credit only granted for: ENCE642 or ENCE743. Formerly: ENCE642.
Review of theory of vibration and wave propagation in elastic media. Field and laboratory methods for determining dynamic soil properties. Analysis and design of soil-foundation systems subjected to machinery generated vibrations and methods of foundation isolation. Earthquake causes, magnitude and intensity, seismic hazard evaluation, NEHRP site classification, site response analyses and ground motion amplification, liquefaction and response of earth structures.

ENCE 744 QA/QC and Specification for Highway Materials (3 credits)
Prerequisite: ENCE300.
Factorial Experiments and Analysis. Materials Variability Components: Inherent and Testing Variability. Quality Control/Quality Assurance: Analysis Methods, Assurance Plans and Components. Specifications for Asphalt and Concrete Materials: Method, End-Result, Performance Based. Life Cycle Analysis and Performance Modeling Techniques. Use of Advanced Statistical Analysis for Material Properties Monitoring and Performance Predictions: ANOVA, Time Series, Spatial Data Analysis. Advanced Highway Materials including Polymer Modified and High Performance Asphalt and Concrete.

ENCE 745 Geoenvironmental Site Remediation (3 credits)
Prerequisite: ENCE340. Credit only granted for: ENCE489R, ENCE688R, or ENCE745. Formerly: ENCE688R.
Analysis of various techniques for remediation of contaminated media, applicable regulations and methods of field reconnaissance, invasive and non-invasive methods of site characterization, geoenvironmental monitoring, vertical cut-off walls, caps, soil vapor extraction systems, air sparging, permeable reactive walls, electro-kinetic remediation, waste stabilization and solidification systems.

ENCE 747 Infrastructure and Pavement Management Systems (3 credits)
Credit only granted for: ENCE688D or ENCE747. Formerly: ENCE688D.
Pavement and Infrastructure Management Systems. System Engineering. Condition Evaluation and Rating, Non Destructive Methods. Performance Evaluation and Modeling. Economic Analysis, Cost and Benefits. Pavement Management Systems:Overview, A Framework for System Design, Project and Network PMS, Pavement Condition and SHRP Surveys, Costs and Benefits of Improved Levels of Pavement Management. PMS Case Studies . Use of Geographic Information Systems (GIS). Systems Concepts Applied to Design. Implementation of Maintenance Management Systems. Bridge Management Systems: Inspection, Rating, Benefits, e.t.c. Building Management Systems: Critical Issues, Private and Public Ownership, Life Cycle Cost. Infrastructure Management Systems.

ENCE 752 Theory of Aqueous Waste Treatment (3 credits)
Theory and practical design of treating wastewater, hydraulics of plant, cost analysis. Biological oxidation of organics and biological nutrient removal are emphasized. Stabilization and disposal of biosolids will be discussed.

ENCE 755 Transformations of Organic Compounds in the Environment (3 credits)
Restriction: Permission of instructor.
Focuses on reaction kinetics and mechanisms of organic pollutants transformations. Kinetic principles will be used to calculate or estimate the pollutants' half-lives. Physical-chemical properties of organic pollutants will be used to estimate transformation mechanisms and rates. Emphasis is on developing an understanding of how physico-chemical and structural properties relate with the transformations of organic pollutants.

ENCE 799 Master's Thesis Research (1-6 credits)

ENCE 898 Pre-Candidacy Research (1-8 credits)

ENCE 899 Doctoral Dissertation Research (1-8 credits)

Engineering, Chemical (ENCH)

ENCH 609 Graduate Seminar (1 credits)

ENCH 610 Chemical Engineering Thermodynamics (3 credits)
Prerequisite: CHBE301; and CHBE302. Or students who have taken courses with comparable content may contact the department. Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department.
Advanced application of the general thermodynamic methods to chemical engineering problems. First and second law consequences; estimation and correlation of thermodynamic properties; phase and chemical reaction equilibria.

ENCH 620 Methods of Engineering Analysis (3 credits)
Prerequisite: MATH246; and CHBE250. Or students who have taken courses with comparable content may contact the department. Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department.
Application of selected mathematical techniques to the analysis and solution of engineering problems; included are the applications of matrices, vectors, tensors, differential equations, integral transforms, and probability methods to such problems as unsteady heat transfer, transient phenomena in mass transfer operations, stagewise processes, chemical reactors, process control, and nuclear reactor physics.

ENCH 630 Transport Phenomena (3 credits)
Prerequisite: CHBE422; and ENCH424. Or students who have taken courses with comparable content may contact the department. Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department.
Heat, mass and momentum transfer theory from the viewpoint of the basic transport equations. Steady and unsteady state; laminar and turbulent flow; boundary layer theory, mechanics of turbulent transport; with specific application to complex chemical engineering situations.

ENCH 640 Advanced Chemical Reaction Kinetics (3 credits)
Prerequisite: CHBE440; or students who have taken courses with comparable content may contact the department. Restriction: Permission of ENGR-Chemical & Biomolecular Engineering department.
The theory and application of chemical reaction kinetics to reactor design. Reaction rate theory; homogeneous batch and flow reactors; fundamentals of catalysis; design of heterogeneous flow reactors.

ENCH 648 Special Problems in Chemical Engineering (1-16 credits)

ENCH 737 Chemical Process Optimization (3 credits)
Techniques of modern optimization theory as applied to chemical engineering problems. Optimization of single and multivariable systems with and without constraints. Application of partial optimization techniques to complex chemical engineering processes. Spring semester.

ENCH 739 Modern Computing Techniques in Process Engineering (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Presentation of recent developments in computing techniques in the context of chemical engineering problems. Symbolic computation and artificial intelligence, neural networks, data filtering and statistical treatment of data.

ENCH 751 Turbulent and Multiphase Transport Phenomena (3 credits)
Prerequisite: ENCH620 and ENCH630.
Basic equations and statistical theories for transport of heat, mass, and momentum in turbulent fluids with applications to processing equipment. Fundamental equations of multiphase flow for dilute systems with applications to particles, drops and bubbles. Current approaches for analysis of concentrated suspensions including deterministic models and population balance approaches.

ENCH 781 Polymer Reaction Engineering (3 credits)
Prerequisite: ENCH640; or permission of instructor.
Advanced topics in polymerization kinetics, reactor design and analysis; addition and step-growth polymerization; homogeneous and heterogeneous polymerization; photopolymerization; reactor dynamics; optimal operation and control of industrial polymerization reactors.

ENCH 799 Master's Thesis Research (1-6 credits)

ENCH 818 Advanced Topics in Thermodynamics (3 credits)
Second semester.

ENCH 828 Advanced Topics in Chemical Reaction Systems (3 credits)
Prerequisite: ENCH640.
First semester. Offered in alternate years.

ENCH 838 Advanced Topics in Transfer Theory (3 credits)
First semester. Offered in alternate years.

ENCH 858 Advanced Topics in Process Control (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Advanced topics in chemical process control -- robust control, model based process control, process sensing, fault detection, expert systems, neural networks, and integration of design and control.

ENCH 859 Advanced Topics in Biochemical Systems (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Presentation of techniques for characterizing and manipulating non-linear biochemical reaction networks. Methods are applied to current biotechnological systems, some include: recombinant bacteria; plant, insect and mammalian cells; and transformed cell lines.

ENCH 868 Advanced Topics of Process Design (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Advanced topics in chemical process analysis and design; construction of process models, steady-state and dynamic simulation, process synthesis, heat-exchanger networks, separation systems, chemical reaction systems, and bioprocesses.

ENCH 869 Advanced Computer-Aided Process Engineering (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Advanced topics and projects involving modern computing techniques in chemical and process engineering. Topics include but not restricted to advanced process simulation; parallel computation; symbolic, Boolean, and algebraic computation in process modelling; molecular-based modelling; connectionist systems.

ENCH 898 Pre-Candidacy Research (1-8 credits)

ENCH 899 Doctoral Dissertation Research (1-8 credits)

Electrical & Computer Engineering (ENEE)

ENEE 407 Microwave-Circuits Laboratory (2 credits)
Prerequisite: Minimum grade of C- in ENEE381; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical).
Experiments concerned with circuits constructed from microwave components providing practical experience in the design, construction and testing of such circuits. Projects include microwave filters and S-parameter design with applications of current technology.

ENEE 408 Capstone Design Project (3 credits)
Prerequisite: Must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Repeatable to 6 credits if content differs.
Culmination of prior course work in electrical and computer engineering. Utilization of modern design tools and methodologies for the design of components or systems under realistic constraints, with particular emphasis on teamwork and oral/written communication. Areas in which projects are currently offered include: microprocessor-based systems, digital systems, VLSI design (both digital and mixed-signal), and optical systems.

ENEE 411 Advanced Analog and Digital Electronics (3 credits)
Prerequisite: Minimum grade of C- in ENEE303. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer) ; and must have permission of the department. Credit only granted for: ENEE411 or ENEE419A. Formerly: ENEE419A.
Examination of analog and digital device models for analysis, design, and simulation of transistor level electronic circuits, emphasizing Metal Oxide Silicon Field Effect Transistors (MOSFETs); fundamental single transistor configurations; frequency response, feedback, and stability of multi-transistor circuits, such as current mirrors, differential amplifiers, voltage references, operational amplifiers and data converters; complementary Metal Oxide Silicon (CMOS) implementations of static and clocked digital as well as mixed signal circuits.

ENEE 413 Advanced Electronic Devices (3 credits)
Prerequisite: Minimum grade of C- in ENEE303. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical) ;

and permission of ENGR-Electrical & Computer Engineering department. Credit only granted for: ENEE413 or ENEE480. Formerly: ENEE480.
Advanced devices and their physical operation, providing a thorough description of those parts not usually covered in introductory electronics courses. These include Schottky and tunnel junctions, negative resistance devices used in wireless communication, homo-structure compound semiconductor transistors, hetero-structure (quantum effect) transistors, non-volatile memory devices, photonic devices such as LEDs and solid-state lasers, solar cells, photo-detectors and camera imagers, as well as bio-related components. Special consideration will be given to achieve an understanding of noise processes that limit electronic device performance. In all cases, system-level applications will be illustrated.

ENEE 416 Integrated Circuit Fabrication Laboratory (3 credits)

Prerequisite: Minimum grade of C- in ENEE303; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Formerly: ENEE419J.
Characterization of wafers and fabrication steps. Oxide growth, lithography, dopant diffusion, and metal deposition and patterning will be discussed in the lectures and carried out in the lab in fabricating NMOS transistor circuits. The transistor characteristics will be measured and related to the fabrication parameters.

ENEE 417 Microelectronics Design Laboratory (2 credits)

Prerequisite: Minimum grade of C- in ENEE303; and minimum grade of C- in ENEE307; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer).
Students design and build fairly sophisticated circuits, mainly composed of discrete transistors and integrated circuits. Many of the projects are designed to require that students synthesize from what they have learned in many of the disciplines in electrical engineering. Students learn they can actually use their knowledge to build something very practical, which may include a high-fidelity amplifier, a radio, a memory cell, a transmitter, etc.

ENEE 419 Topics in Microelectronics (1-3 credits)

Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer). Repeatable to 99 credits if content differs.
Selected topics of current importance in microelectronics.

ENEE 420 Communication Systems (3 credits)

Prerequisite: ENEE324; and completion of all lower-division technical courses in the EE curriculum.
Fourier series, Fourier transforms and linear system analysis; random signals, autocorrelation functions and power spectral densities; analog communication systems: amplitude modulation, single-sideband modulation, frequency and phase modulation, sampling theorem and pulse-amplitude modulation; digital communication systems pulse-code modulation, phase-shift keying, differential phase shift keying, frequency shift keying; performance of analog and digital communication systems in the presence of noise.

ENEE 425 Digital Signal Processing (3 credits)

Prerequisite: ENEE322; and completion of all lower-division technical courses in the EE curriculum.
Sampling as a modulation process; aliasing; the sampling theorem; the Z-transform and discrete-time system analysis; direct and computer-aided design of recursive and nonrecursive digital filters; the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT); digital filtering using the FFT; analog-to-digital and digital-to analog conversion; effects of quantization and finite-word-length arithmetic.

ENEE 426 Communication Networks (3 credits)

Prerequisite: ENEE324; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in Engineering: Electrical program.
The main design issues associated with computer networks, satellite systems, radio nets, and general communication networks. Application of analytical tools of queuing theory to design problems in such networks. Review of proposed architectures and protocols.

ENEE 428 Communications Design Laboratory (2 credits)

Prerequisite: ENEE324; and completion of all lower-division technical courses in the EE curriculum. Corequisite: ENEE425 or ENEE420. Restriction: Must be in Engineering: Electrical program.
EE capstone design course. Exploring the signal processing and communication systems theoretical concepts presented in ENEE 420 Communication Systems and ENEE 425 Digital Signal Processing by implementing them on actual DSP based hardware in real time.

ENEE 429 Topics in Communications (1-3 credits)

Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer). Repeatable to 99 credits if content differs.
Selected topics of current importance in communications.

ENEE 435 Introduction to Electrical Processes, Structure and Computing Models of the Brain (3 credits)

Prerequisite: Minimum grade of C- in ENEE205; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer).
Concepts, theoretical and experimental probing methods and models for understanding the human brain structures and functions from an engineering viewpoint. Bioelectric phenomena of cells and electrical circuit functional models. Neurons as signal generators, decision elements, and information transmission and processing devices. Basic neural circuits and models. Experimental techniques, signal recording and analysis. Brain architecture-communication, control and information processing structures and functions. Memory, associations learning and higher brain functions. Computer simulations and computational models. Overview of brain-inspired intelligent machine approaches and systems.

ENEE 439 Topics in Signal Processing (1-3 credits)

Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Repeatable to 99 credits if content differs.
Selected topics of current importance in signal processing.

ENEE 440 Microprocessors (3 credits)

Prerequisite: ENEE350; and completion of all lower division technical courses in the EE curriculum. Restriction: Must be in one of the

following programs (Engineering: Computer; Engineering: Electrical).
Microprocessor architectures, instruction sets, and applications. Bus structures, memory, I/O interfacing. Assembly language programming, LSI device configuration, and the embedding of microprocessors in systems.

ENEE 445 Computer Laboratory (2 credits)

Prerequisite: Minimum grade of C- in ENEE205; or minimum grade of C- in ENEE206. And minimum grade of C- in ENEE350; and must have earned a minimum grade of regular (letter) C- in all 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical).
This laboratory course focuses on the hardware/software interface in computer systems. Hand-on experiments are used to teach design, construction, analysis, and measurement of both hardware and software for embedded systems. Projects emphasize using microcontrollers for control, sensing, and communication through various I/O devices.

ENEE 446 Digital Computer Design (3 credits)

Prerequisite: ENEE350; and completion of all lower-division technical courses in the EE curriculum.
Hardware design of digital computers. Arithmetic and logic units, adders, multipliers and dividers. Floating-point arithmetic units. Bus and register structures. Control units, both hardwired and microprogrammed. Index registers, stacks, and other addressing schemes. Interrupts, DMA and interfacing.

ENEE 447 Operating Systems (4 credits)

Prerequisite: CMSC330, CMSC351, and ENEE350; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in Engineering: Computer program; and permission of ENGR-Electrical & Computer Engineering department. Credit only granted for: ENEE447, CMSC412, or ENEE459S. Formerly: ENEE459S.
The course will present the theory, design, implementation and analysis of computer operating systems. Through classroom lectures, homework, and projects, students learn the fundamentals of concurrency, process management, interprocess communication and synchronization, job scheduling algorithms, memory management, input-output devices, file systems, and protection and security in operating systems. Optional topics may include communications protocols, computer security, and real-time operating systems. The lectures will be complemented with a significant level of programming, bringing up a simple operating system from scratch, concurrently as the topics are discussed in lecture. A weekly recitation section will provide TA support and an informal laboratory atmosphere. Each student will have their own board, so development will be done largely outside the classroom at each student's pace.

ENEE 459 Topics in Computer Engineering (1-3 credits)

Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Repeatable to 99 credits if content differs.
Selected topics of current importance in computer engineering.

ENEE 460 Control Systems (3 credits)

Prerequisite: ENEE322; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in Engineering: Electrical program.
Mathematical models for control system components. Transform and time domain methods for linear control systems. Introductory stability theory. Root locus, bode diagrams and Nyquist plots. Design specifications in the time and frequency domains. Compensation design in the time and frequency domain. Introduction to sampled data systems.

ENEE 461 Control Systems Laboratory (3 credits)

Prerequisite: Minimum grade of C- in ENEE205; and minimum grade of C- in ENEE322; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Credit only granted for: ENEE461, ENME461, or ENME489N.
Students will design, implement, and test controllers for a variety of systems. This will enhance their understanding of feedback control and familiarize them with the characteristics and limitations of real control devices. They will also complete a small project. This will entail writing a proposal, purchasing parts for their controller, building the system, testing it, and writing a final report describing what they have done.

ENEE 463 Digital Control Systems (3 credits)

Prerequisite: ENEE322; and completion of lower-division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer). Formerly: ENEE469E.
Introduction to techniques for the analysis and design of linear control systems and implementation of control systems using digital technology. Topics include linearization, solution of linear equations, z-transforms and Laplace transforms, design of linear controllers, optimal control, and digital implementation of control designs. Students will use MATLAB for the solution of problems and the design of control systems.

ENEE 469 Topics in Controls (1-3 credits)

Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Repeatable to 99 credits if content differs.
Selected topics of current importance in controls.

ENEE 473 Electrical Machines Laboratory (2 credits)

Prerequisite: Minimum grade of C- in ENEE205; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Recommended: ENEE322. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer).
Experiments involving single and three phase transformers, induction machines, synchronous machines and D.C. machines.

ENEE 474 Power Systems (3 credits)

Prerequisite: ENEE322; and completion of all lower-division technical courses in the EE curriculum.
Interconnected power systems, transmission lines, load flow studies, unit commitment and economic dispatch. Three phase networks, machine models. Symmetrical components, fault analysis and unbalanced operation. Power system transients, stability and numerical methods in power system analysis.

ENEE 475 Power Electronics (3 credits)

Prerequisite: Minimum grade of C- in ENEE303; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer).
This course is suitable for undergraduate and graduate students who want to learn the basic principles of power electronics and its applications. Special emphasis is placed on interdisciplinary nature of power

electronics. Strong and intimate connections between power electronics and circuit theory, electronic circuits, semiconductor devices, electric power, magnetic, motor drives and control are stressed.

ENEE 486 Optoelectronics Lab (2 credits)
Prerequisite: Minimum grade of C- in ENEE205; or minimum grade of C- in ENEE206. And minimum grade of C- in PHYS271 and PHYS270; and must have earned a minimum grade of regular (letter) C- in all required 200-level ENEE courses; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical).
Hands-on experience in performing measurements in optics and electro-optics. Basics of optics, light detectors, Fourier optics, gratings and spectrometers, pulsed dye lasers, fiber optics, electro-optics, and acousto-optics.

ENEE 488 Independent Study in Electrical and Computer Engineering (1-3 credits)
Prerequisite: Must have completed and earned a minimum grade of regular (letter) C- in all lower-division EE or CP tech electives; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Repeatable to 9 credits if content differs. Additional information: A total of 5 credits combined of ENEE488 and ENEE499 can count towards a degree in electrical and computer engineering.
The purpose is to provide students with an opportunity for independent study projects on advanced electrical and computer engineering topics. These projects typically involve academic investigations of technical themes that are not addressed in the established elective and special topics courses taught by the department on a regular basis. Study plans are tailored to students educational goals but are approved and supervised by faculty.

ENEE 489 Topics in Electrophysics (1-3 credits)
Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Repeatable to 99 credits if content differs.
Selected topics of current importance in electrophysics.

ENEE 490 Physical Principles of Wireless Communications (3 credits)
Prerequisite: ENEE381. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical). Credit only granted for: ENEE490 or ENEE498B. Formerly: ENEE498B.

ENEE 496 Lasers and Electro-optic Devices (3 credits)
Prerequisite: ENEE381; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical).
Modern physical optics: Gaussian beams, optical resonators, optical waveguides; theory of laser oscillation, rate equations; common laser systems. Selected modern optoelectronic devices like detectors and modulators. Role of lasers and optoelectronics in modern technology.

ENEE 498 Topics in Electrical Engineering (1-3 credits)
Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in Engineering: Electrical program. Repeatable to 99 credits if content differs. Formerly: ENEE488.
Selected topics of current importance in electrical engineering.

ENEE 499 Senior Projects in Electrical and Computer Engineering (1-5 credits)
Prerequisite: Permission of ENGR-Electrical & Computer Engineering department; and completion of all lower-division technical courses in the EE curriculum. Restriction: Must be in Engineering: Electrical program. Repeatable to 9 credits if content differs. Formerly: ENEE418. Additional information: A total of 5 credits combined of ENEE448 and ENEE499 can count toward a degree in electrical or computer engineering.
The purpose is to provide students with an opportunity to engage in independent research projects on advanced electrical and computer engineering topics. Projects are selected by students and supervised by faculty and other qualified mentors. While students may be required to acquire new skills or information in the course of completing a 499 project, the focus is to conduct an independent investigation of a technical theme by the student. The project may be used to satisfy the advanced lab requirement if it is approved as a primarily - experimental research project. In that case, the student will enroll in ENEE499L.

ENEE 600 Solid State Electronics (3 credits)
Prerequisite: ENEE413; and must have background in elementary quantum mechanics. Credit only granted for: ENEE600 or ENEE793. Formerly: ENEE793.
Properties of crystals; energy bands: electron transport theory; conductivity and hall effect; statistical distributions; fermi level: impurities; non-equilibrium carrier distributions; normal modes of lattice vibration and thermal properties of crystals; tunneling phenomena; surface properties.

ENEE 601 Semiconductor Devices and Technology (3 credits)
Recommended: ENEE413 and ENEE600. Credit only granted for: ENEE601 or ENEE697. Formerly: ENEE697.
The principles, structures and characteristics of semiconductor devices. Technology and fabrication of semiconductor devices.

ENEE 605 Design and Fabrication of Micro-Electro-Mechanical Systems (MEMS) (3 credits)
Credit only granted for: ENEE605 or ENEE719R. Formerly: ENEE719R.
The goals are to explore the world of Micro-Electro-Mechanical Systems (MEMS) by understanding its design and fabrication aspects.

ENEE 610 Electrical Network Theory (3 credits)
Prerequisite: Must have completed undergraduate-level Circuit Theory; or permission of instructor.
Matrix algebra, network elements, ports, passivity and activity, geometrical and analytical descriptions of networks, state variable characterizations, scattering matrices, signal flow graphs, sensitivity.

ENEE 611 Integrated Circuit Design and Analysis (3 credits)
Recommended: ENEE610. Credit only granted for: ENEE611 or ENEE696. Formerly: ENEE696.
Active and passive elements used in semiconductor structures. Design application of linear and digital integrated circuits.

ENEE 614 Radio Frequency VLSI Circuit Design (3 credits)
Recommended: ENEE611.
This course will give students the knowledge required to analyze, design and lay-out discrete and integrated circuits used in modern radio frequency communications. The course will focus on advanced amplifier concepts, frequency conversion, tuning, and low-noise techniques. Implementation of AM, FM

and digital modulation techniques will be covered. Emphasis will be given to CMOS technology as applied to analog VLSI. Advanced applications of SPICE and VLSI design layout tools will be covered.

ENEE 620 Random Processes in Communication and Control (3 credits)

Prerequisite: ENEE324; or students who have taken courses with comparable content may contact the department.

Introduction to random processes: characterization, classification, representation; Gaussian and other examples. Linear operations on random processes, stationary processes: covariance function and spectral density. Linear least square waveform estimating Wiener-Kolmogroff filtering, Kalman-Bucy recursive filtering: function space characterization, non-linear operations on random processes.

ENEE 621 Estimation and Detection Theory (3 credits)

Prerequisite: ENEE620; or students who have taken courses with comparable content may contact the department.

Estimation of unknown parameters, Cramer-Rao lower bound; optimum (map) demodulation; filtering, amplitude and angle modulation, comparison with conventional systems; statistical decision theory Bayes, minimax, Neyman/Pearson, Criteria-68 simple and composite hypotheses; application to coherent and incoherent signal detection; M-ary hypotheses; application to uncoded and coded digital communication systems.

ENEE 623 Digital Communications (3 credits)

Recommended: ENEE420.

Review of sampling and quantization, functional characterization of digital signals and transmission facilities, band-limited signals and systems. Digital modulation/demodulation techniques, error probability, intersymbol interference and its effects, adaptive equalization. Signaling with coded waveforms, fading and satellite channels, multiple access problems and protocols. Introduction to spread-spectrum Communications.

ENEE 625 Multi-user Communication (3 credits)

Prerequisite: ENEE620.

Basic queueing models. Store-and forward communications networks; switching modes; delay-throughput measures; capacity assignment; routing; topological design; computational aspects; flow control; error control; protocols; specification and validation; local networks; satellite and packet radio systems; multiple access schemes; stability and performance; multi-user information theory; and large scale system theory.

ENEE 626 Error Correcting Codes (3 credits)

Prerequisite: ENEE420; or students who have taken courses with comparable content may contact the department. Credit only granted for: ENEE626 or ENEE722. Formerly: ENEE722.

Introduction to linear codes; bounds on the error correction capabilities of codes; convolutional codes with threshold, sequential and viterbi decoding; cyclic random error correcting codes; P-N sequences; cyclic and convolutional burst error correcting codes.

ENEE 627 Information Theory (3 credits)

Prerequisite: ENEE620. Credit only granted for: ENEE627 or ENEE721. Formerly: ENEE721.

Information measures and their properties; entropy, relative entropy and mutual information. Information source models. Lossless data compression: the Kraft inequality, Shannon-Fano and Huffman codes. Typical sequences, asymptotic equipartition property, lossy source coding. Discrete memoryless channels: capacity, channel coding theorem. The additive Gaussian channel. Source coding under a fidelity constraint: rate distortion function and rate distortion theorem.

ENEE 630 Advanced Digital Signal Processing (3 credits)

Prerequisite: ENEE425. Corequisite: ENEE620. Credit only granted for: ENEE624 or ENEE630. Formerly: ENEE624.

This is the first-year graduate course in signal processing. The objective is to establish fundamental concepts of signal processing on multirate processing, parametric modeling, linear prediction theory, modern spectral estimation, and high-resolution techniques.

ENEE 631 Digital Image and Video Processing (3 credits)

Prerequisite: ENEE620 and ENEE630; or students who have taken courses with comparable content may contact the department.

Foundations of digital image and video processing. Topics covered: 2-D systems and transforms; image acquisition and perception; multi-dimensional sampling; quantization; linear and non-linear techniques for image enhancement and restoration; basics on image analysis; lossless and lossy image compression; motion estimation and compensation; still image and video coding standards; applications of image and video processing.

ENEE 632 Speech and Audio Processing (3 credits)

Prerequisite: ENEE620 and ENEE630. Credit only granted for: ENEE739A or ENEE632. Formerly: ENEE739A.

The objective is to apply digital signal processing techniques to speech and music signals. Topics covered include acoustic theory of speech production leading to the source-filter model; acoustic and digital vocal-tract models of speech production; speech analysis-synthesis based on the short-time Fourier transform, linear prediction, and homomorphic representations; extensions to other multiresolution analysis; time-domain models for speech processing; auditory perception and speech perception; waveform and model-based speech coding using scalar and vector quantization; time-scale modification; pitch and formant estimation; application of techniques to music analysis-synthesis.

ENEE 633 Statistical Pattern Recognition (3 credits)

Prerequisite: MATH461; or students who have taken courses with comparable content may contact the department; or permission of instructor. Corequisite: ENEE620. Credit only granted for: ENEE633 or ENEE739Q. Formerly: ENEE739Q.

The goal is to introduce mathematical pattern analysis and recognition. Emphasis is given to parametric and non-parametric statistical pattern recognition methods and clustering with applications to speech, image and video recognition.

ENEE 634 Space-Time Signal Process (3 credits)

Prerequisite: ENEE620 and ENEE630. Credit only granted for: ENEE634 or ENEE724. Formerly: ENEE724.

Space-time processing aspects of signal processing with applications to wireless communications are considered, including fast algorithms, numerical computation, adaptive beamforming, direction of arrivals estimation, array processing, adaptive algorithms (least means square algorithms and recursive least means square algorithms), channel equalization, blind equalization and identification, and space-time coding, modulation, and MIMO communications and signal processing.

ENEE 640 Digital CMOS VLSI Design (3 credits)

Prerequisite: ENEE303 and ENEE350; or students who have taken courses with comparable content may contact the department; or permission of instructor.

Review of MOS transistors: fabrication, layout, characterization; CMOS circuit and logic design: circuit and logic simulation, fully complementary CMOS logic, pseudo-nMOS logic, dynamic CMOS logic, pass-transistor logic, clocking strategies; sub system design: ALUs, multipliers, memories, PLAs; architecture design: datapath, floorplanning, iterative cellular arrays, systolic arrays; VLSI algorithms; chip design and test: full custom design of chips, possible chip fabrication by MOSIS and subsequent chip testing.

ENEE 641 Mathematical Foundations for Computer Engineering (3 credits)
Credit only granted for: ENEE641 or ENEE759F. Formerly: ENEE759F.
Mathematical modeling, design, analysis and proof techniques related to computer engineering. Probability, logic, combinatorics, set theory, and graph theory, as they pertain to the design and performance of computer engineering systems. Techniques for the design and analysis of efficient computational methods from graph theory and networks. Understanding of the limits on the efficiency of such computational methods. Translation from mathematical theory to actual programming. The course emphasizes mathematical rigor.

ENEE 644 Computer-Aided Design of Digital Systems (3 credits)
Design methodologies for digital systems using a modern hardware description language. Algorithmic, architectural and implementation aspects of arithmetic processing elements. Design of Complex Instruction Set (CISC), Reduced Instruction Set (RISC), and floating point processors. Synthesis, simulation and testing of processors with computer-aided design tools. Students in some sections may, on permission, fabricate VLSI chips via MOSIS.

ENEE 645 Compilers and Optimization (3 credits)
Prerequisite: ENEE350 or CMSC216; or students who have taken courses with comparable content may contact the department. Credit only granted for: ENEE645 or ENEE759C. Formerly: ENEE759C.
The compilation, linking and loading process. Using lexical analyzers and parsers. Intermediate forms. Global, stack and heap objects, and their addressing modes. Stack implementation. Control flow analysis and optimization. Dataflow analysis and optimization including Static, single assignment. Alias analysis.

ENEE 646 Digital Computer Design (3 credits)
Prerequisite: ENEE446; or students who have taken courses with comparable content may contact the department.
Concepts and techniques for design of computer systems with improved performance. Advanced I/O systems, memory organization, pipeland and parallel processors, bus bandwidth, processor/memory interconnections, cache memory, virtual memory, multiprocessors, performance evaluation.

ENEE 647 Design of Distributed Computer Systems (3 credits)
Prerequisite: ENEE488.
Communication protocols, models of interprocess communication and synchronization in distributed operating systems, interprocess synchronization and communication primitives; remote procedure call protocols; electronic mail and store-and-forward communication; deadlock handling in distributed systems; processes and transactions in distributed systems; client servers models of computation; distributed shared memory; distributed file systems; recovery and fault-tolerance; protection and communication security.

ENEE 648 Advanced Topics in Electrical Engineering (3 credits)
Every semester courses intended for high degree of specialization are offered by visiting or regular electrical engineering faculty members in two or more of the areas listed in 488. The student should check with the electrical engineering office of graduate studies for a list and the description of the topics offered currently.

ENEE 651 Parallel Algorithms (3 credits)
Prerequisite: CMSC451; or ENEE641; or students who have taken courses with comparable content may contact the department. Also offered as: CMSC751. Credit only granted for: ENEE651, ENEE759K or CMSC751. Formerly: ENEE759K.
A presentation of the theory of parallel computers and parallel processing. Models of parallel processing and the relationships between these models. Techniques for the design and analysis of efficient parallel algorithms including parallel prefix, searching, sorting, graph problems, and algebraic problems. Theoretical limits of parallelism.

ENEE 660 System Theory (3 credits)
Prerequisite: ENEE460 and MATH463; or students who have taken courses with comparable content may contact the department.
General systems models. State variables and state space. Linearity and its implications. Controllability and observability. State space structure and representation. Realization theory and algorithmic solutions. Parameterizations of linear systems; canonical forms. Basic results from stability theory. Stabilizability. Fine structure of linear multivariable systems; minimal indices and polynomial matrices. Interplay between frequency domain and state space.

ENEE 661 Nonlinear Control Systems (3 credits)
Prerequisite: ENEE660; and (MATH410 or MATH411; or students who have taken courses with comparable content may contact the department). Or permission of instructor.
State space methods of stability analysis including second order systems and the phase plane, linearization and stability in the small, stability in the large and Lyapunov's second method. Frequency domain methods including the describing function. Popov's method and functional analytic methods. Introduction to Volterra series representations of nonlinear systems. Applications to conrol system design.

ENEE 662 Convex Optimization (3 credits)
Recommended: MATH410. Credit only granted for: ENEE759F or ENEE662.
Focuses on recognizing, solving, and analyzing convex optimization problems. Convex sets, convex functions, convex and quasi-convex optimization problems. Duality theory and optimality conditions. Specific classes of problems including linear optimization (LP), semi-definite optimization (SDP), geometric programming. Algorithms for unconstrained and constrained optimization; interior-point methods. Applications in controls, communications, signal processing, statistics, and other areas.

ENEE 664 Optimal Control (3 credits)
Prerequisite: ENEE660 and MATH410; or students who have taken courses with comparable content may contact the department; or permission of instructor. Corequisite: MATH411; or permission of instructor.
General optimization and control problems. Conditions of optimality for unconstrained and constrained optimization problems; sensitivity; duality. Introduction to linear and nonlinear programming methods. Dynamic optimization. Discrete time maximum principle and applications. Pontryagin maximum principle in continuous time. Dynamic programming. Feedback realization of optimal control.

ENEE 680 Electromagnetic Theory I (3 credits)
Prerequisite: ENEE381; or students who have taken courses with comparable content may contact the department.
Theoretical analysis and engineering applications of Maxwell's equations. Boundary value problems of electrostatics and magnetostatics.

ENEE 681 Electromagnetic Theory II (3 credits)
Prerequisite: ENEE381; or students who have taken courses with comparable content may contact the department.
Continuation of ENEE 680. Theoretical analysis and engineering applications of Maxwell's equations. The homogeneous wave equation. Plane wave propagation. The interaction of plane waves and material media. Retarded potentials. The Hertz potential. Simple radiating systems.

Relativisitic covariance of Maxwell's equations.

ENEE 686 Charged Particle Dynamics, Electron and Ion Beams (3 credits)
Restriction: Permission of instructor.
General principles of single-particle dynamics; mapping of the electric and magnetic fields; equation of motion and methods of solution; production and control of charge particle beams; electron optics; Liouville's theorem; space charge effects in high current beams; design principles of special electron and ion beam devices.

ENEE 690 Quantum and Wave Phenomena with Electrical Application (3 credits)
Prerequisite: ENEE381; or students who have taken courses with comparable content may contact the department.
Introduction of quantum and wave phenomena from electrical engineering point of view. Topics included: general principles of quantum mechanics, operator algebra, the microwave resonant cavity and the analagous potential well problem, harmonic oscillator, hydrogenic atom. Perturbation method applied to the transmission line and potential well problems. Periodically loaded transmission line and Kronig-Penny model of band theory.

ENEE 691 Optical Communication Systems (3 credits)
Optical components and systems. Measures of performance of optical communication systems. Topics include: single and multi-mode optical fibers, DFB and DBR lasers, transmitters and receivers, pin and APD detectors, noise analysis, receiver sensitivity modulation formats, system performance, bit-error-rate, power budget, TDM and WDM systems, network architecture.

ENEE 698 Graduate Seminar (1-3 credits)
Restriction: Permission of instructor.
Every semester regular seminars are held in electrical science and in the six areas of specialization offered by the electrical engineering department. They may be taken, by arrangement with the student's advisor, for repeated credit.

ENEE 699 Independent Studies in Electrical Engineering (1-3 credits)
Repeatable to 99 credits if content differs. Formerly: ENEE609.
Supervised individual study or project, or supervised group study or project, at an advanced level, in electrical engineering.

ENEE 704 Physics and Simulation of Semiconductor Devices (3 credits)
Recommended: ENEE601 and ENEE600; and exposure to quantum mechanics. Credit only granted for: ENEE694 and ENEE704. Formerly: ENEE694.
The physics of electron transport in semiconductor devices will be covered. Numerical methods for attaining solutions to transport equations will be explored. Students will also learn how to use CAD tools fro semiconductor device design. Nano-electronic devices will be introduced.

ENEE 719 Advanced Topics in Microelectronics (3 credits)
Repeatable to 99 credits if content differs. Formerly: ENEE718.

ENEE 720 Wireless Communication Theory (3 credits)
Prerequisite: ENEE620 and ENEE621. Credit only granted for: ENEE720 or ENEE729W. Formerly: ENEE729W.
An advanced detection course that follows and builds on the foundations of the single-user detection theory covered in ENEE 621. The main goal is to introduce the students to the multiple-user communication theory, in particular, multi-user detection theory. Students are introduced to the multi-user performance criteria of effective energy, asymptotic multi-user efficiency and near-far resistance. The physical layer techniques of diversity reception/transmission, multiple transmit/receive antennas and beamforming will also be studied.

ENEE 723 Wireless Communication Networks (3 credits)
Prerequisite: ENEE625 and ENEE620; or students who have taken courses with comparable content may contact the department.
Reviews the fundamental characteristics of wireless networks by focusing on the wireless link, on the media access control, and on interference issues. It reviews the cellular architecture model with emphasis on bandwidth reuse, power control, handoffs, and mobility tracking. It then considers wireless local area networks with focus on routing/multicasting and on capacity notions. It also considers the principles of layer integration and energy efficiency and it reviews the special cases of sensor networks and satellite systems.

ENEE 725 Advanced Networking (3 credits)
Prerequisite: ENEE625; or students who have taken courses with comparable content may contact the department.
This is a second-year graduate course in networking. The objective of the course is to teach the current and new protocols and techniques for modeling a network.

ENEE 729 Advanced Topics in Communication (3 credits)
Repeatable to 99 credits if content differs. Formerly: ENEE728.

ENEE 731 Image Understanding (3 credits)
Prerequisite: ENEE631 and ENEE633. Credit only granted for: ENEE739J or ENEE731. Formerly: ENEE739J.
An advanced graduate level course on image understanding. Mathematical and statistical approaches to solving image understanding problems will be discussed. Topics to be covered include: optimal edge and shape detection; image understanding using Markov random field models; Monte Carlo Markov Chain techniques for image understanding; shape from shading, stereo, texture and contour; structure from motion and object recognition. Existence, uniqueness and convergence issues for many of these problems will be discussed.

ENEE 739 Advanced Topics in Signal Processing (3 credits)
Repeatable to 99 credits if content differs. Formerly: ENEE738.

ENEE 749 Advanced Digital Systems Design (3 credits)
Prerequisite: ENEE640 or ENEE644. Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
VLSI architecture and algorithms; design strategies; design methodologies; system-level design; area/delay/power trade-offs; high performance systems; multi-chip modules; low-power design; hardware/software co-design; design for testability, design for manufacturability; algorithm, architecture, and component design for adaptive computing systems; prototype system development and test, possible chip fabrication by MOSIS and subsequent chip testing.

ENEE 750 VLSI Design Automation (3 credits)
Prerequisite: ENEE640. Restriction: Permission of instructor.
Design process of VLSI circuits and systems; Computer-Aided Design (CAD) tools; system partitioning, floorplanning, placement, global and detailed routing; Field Programmable Gate Arrays (FPGAs), Multi-Chip Modules (MCMs), Printed Circuit Boards (PCBs), possible chip fabrication by MOSIS and subsequent chip testing.

ENEE 757 Security in Distributed Systems and Networks (3 credits)
Prerequisite: ENEE647; or permission of instructor.

Threats and countermeasures in centralized and distributed systems; communication security techniques based on encryption; symmetric and asymmetric encryption; encryption modes, including stream and block encryption, and cipher block chaining; message origin and mutual authentication; third-party and inter-realm authentication, authentication of mobile users; data confidentiality and integrity protocols; formal analysis of authentication protocols and message integrity; access control in distributed systems and networks; firewall design; case studies of security mechanisms and policies.

ENEE 759 Advanced Topics in Computer Engineering (3 credits)
Repeatable to 99 credits if content differs.
Topics, as announced every semester, from the field of computer engineering and its applications.

ENEE 762 Stochastic Control (3 credits)
Prerequisite: ENEE620 and ENEE660; or students who have taken courses with comparable content may contact the department.
Stochastic control systems, numerical methods for the Ricatti equation, the separation principle, control of linear systems with Gaussian signals and quadratic cost, non-linear stochastic control, stochastic stability, introduction to stochastic games.

ENEE 763 Advanced Nonlinear Control Systems (3 credits)
Prerequisite: ENEE661; or permission of instructor.
General introduction to the geometric theory of nonlinear control systems. Theory of decoupling, disturbance rejection, feedback linearization, stability, stabilization, etc.

ENEE 765 Adaptive Control (3 credits)
Prerequisite: ENEE660 and ENEE664; or students who have taken courses with comparable content may contact the department.
General principles of adaptive control. Self-tuning regulators and model reference adaptive systems. Theoretical issues: stability, convergence, and robustness. Practical issues: implementation, computation, auto-tuning, and other successful application. Alternatives to adaptive control.

ENEE 769 Advanced Topics in Controls (3 credits)
Repeatable to 99 credits if content differs.
Topics selected, as announced every semester, from the field of controls and its applications.

ENEE 780 Microwave Engineering (3 credits)
Prerequisite: ENEE681.
Mathematical methods for the solution of the wave equation, transmission lines and waveguides, selected topics in the theory of waveguide structures, surface guides and artificial dielectrics.

ENEE 789 Advanced Topics in Electrophysics (3 credits)
Repeatable to 99 credits if content differs. Formerly: ENEE788.
Topics selected, as announced every semester, from the field of electrophysics and its applications.

ENEE 790 Quantum Electronics I (3 credits)
Prerequisite: Must have knowledge of quantum mechanics; or permission of instructor.
Spontaneous emission, interaction of radiation and matter, masers, optical resonators, the gas, solid and semi-conductor lasers, electro-optical effect, propagation in anisotropic media and light modulation.

ENEE 791 Quantum Electronics II (3 credits)
Nonlinear optical effects and devices, tunable coherent light sources: optical parametric oscillator; frequency conversion and dye laser. Ultrashort pulse generation and measurement, stimulated raman effect, and applications. Interaction of acoustic and optical waves, and holography.

ENEE 798 Advanced Topics in Electrical Engineering (3 credits)
Formerly: ENEE648.
Topics selected, as announced every semester.

ENEE 799 Master's Thesis Research (1-6 credits)

ENEE 889 Teaching Workshop (1 credits)
Restriction: Must be in ENGR: MS/PhD-Electrical Engineering (Doctoral) program; and permission of ENGR-Electrical & Computer Engineering department. Repeatable to 4 credits if content differs.
Provide training in education for senior PhD students who contemplate an academic career, and give them the opportunity to gain some teaching experience. Emphasis is on issues that are of special importance in electrical and computer engineering education.

ENEE 898 Pre-Candidacy Research (1-8 credits)
Restriction: Must be in ENGR: MS/PhD-Electrical Engineering (Doctoral) program; and permission of ENGR-Electrical & Computer Engineering department. Repeatable to 4 credits if content differs.
Provide training in education for senior PhD students who contemplate an academic career, and give them the opportunity to gain some teaching experience. Emphasis is on issues that are of special importance in electrical and computer engineering education.

ENEE 899 Doctoral Dissertation Research (1-8 credits)

Engineering Science (ENES)

ENES 424 Engineering Leadership Capstone (3 credits)
Prerequisite: ENES472, ENCE320, and ENES317; and permission of ENGR-A. James Clark School of Engineering. Recommended: ENES100.
The work initiated in the Introduction to Engineering Leadership course brings together further exploration of leadership styles and concepts.

ENES 435 Product Liability and Regulation (3 credits)
Key topics include, biotechnology, safety regulation, federal preemption, product liability, professional negligence, antitrust, privacy and information technology, risk modeling, environmental protection, patent, copyright, trade secrets, reverse engineering, scientific and technological evidence, international trade, engineering ethics. Examples include plane crashes, computer chip protection, human machine interfaces, nuclear power plants, internet censorship, flood control, earthquakes and biomedical technology.

ENES 440 Science, Technology and Society: Certificate Program Capstone (3 credits)
Restriction: Must be in the Science, Technology and Society certificate program; or permission of ENGR-A. James Clark School of Engineering. Credit only granted for: ENES440 or UNIV401. Formerly: UNIV401.
Capstone research seminar for students in the Science, Technology and Society certificate program.

ENES 458 Topics in International Engineering (1-4 credits)
Prerequisite: ENES100. Repeatable to 12 credits if content differs.
A variety of topics related to engineering in a global context are discussed including cultural aspects, cross-cultural communication, international standards and law, and engineering and technology

issues, business behavior, attitudes and values of selected countries and regions.

ENES 459 Study Abroad Special Topics in Engineering IV (1-6 credits)

Repeatable to 15 credits if content differs.

Special topics course in engineering science taken as part of an approved study abroad program.

ENES 460 Fundamentals of Technology Start-Up Ventures (3 credits)

Formerly: ENES489A.

Fundamental aspects of creating, organizing, funding, managing, and growing a technology startup venture. This multidisciplinary course will draw on management, business, legal, financial, as well as technical, concepts. Students form teams and develop a business plan for a technology company, based on each team's own business idea and then present the plan to a panel of outside experts.

ENES 461 Advanced Entrepreneurial Opportunity Analysis in Technology Ventures (3 credits)

Explores the factors that influence entrepreneurial opportunity analysis in technology-based ventures. Uses a cognitive theoretical framework to examine the integration of motivation, emotions and information processing modes to make complex entrepreneurial decisions in fast pace technology venture environments.

ENES 462 Marketing High-Technology Products and Innovations (3 credits)

Examines the opportunities and challenges of marketing high-technology products in turbulent environments requiring rapid decision making with incomplete information. Explores how innovations are introduced at frequent intervals, research-and-development spending is vital, and there are high mortality rates for both products and businesses.

ENES 463 Strategies for Managing Innovation (3 credits)

Emphasizes how the technology entrepreneur can use strategic management of innovation and technology to enhance firm performance. Examines the process of technological change, the ways that firms come up with innovations, the strategies that firms use to benefit from innovation, and the process of formulating technology strategy. Provides frameworks for analyzing key aspects of these industries and teaches students how to apply these frameworks.

ENES 464 International Entrepreneurship and Innovation (3 credits)

Focuses on the need for every entrepreneur and innovator to understand the global market in today's hypercompetitive world, and to appreciate how to compete effectively in domestic markets by managing international competitors, suppliers, and influences. Explore how the distinction between foreign and domestic markets is becoming less pronounced. Develop skills to identify and manage opportunities on a global basis.

ENES 465 Entrepreneurial Design Thinking (3 credits)

Explores the use of design thinking as an approach to developing customer-centered solutions to problems and fostering sustained innovation within an orgranization. Through interactive lectures, discussions, and hands-on, team-based activities, students will learn design thinking strategies and apply them to finding innovative product- or service-based solutions to contemporary issues.

ENES 466 Leading and Financing the Technology Venture (3 credits)

Credit only granted for: ENES466 or BMGT365. Additional information: Course cannot be used to satisfy a major requirement for the Smith School of Business.

Focuses on the challenges of leading and financing new technology ventures. Leadership topics include team selection and formation, aligning rewards with relative contributions of team members, and how early decisions can enable or prevent founders from achieving results that align with their individual motivations for becoming an entrepreneur. Essential tools and methods for building a strong financial foundation for a new technology venture are examined. Includes important accounting principles as well as methods for keeping financial control of the technology venture. Insights are shared on navigating the multitude of financial barriers that may block your entrepreneurial success, as well as how to grow the technology venture from concept through launch.

ENES 472 International Business Cultures in Engineering and Technology (3 credits)

Prerequisite: Permission of ENGR-A. James Clark School of Engineering. Restriction: Sophomore standing or higher. Also offered as: SLLC472. Credit only granted for: ARHU439B, ARHU439E, ARHU439T, ENES472, SLLC471, SLLC472, or SLLC473. Formerly: ARHU439T.

The goal is to provide students with an understanding of cultural aspects pertaining to global business and engineering and develop the cultural understanding, attitudes, and communication skills needed to function appropriately within an increasingly global and multicultural working environment.

ENES 474 Global Perspectives of Engineering (3 credits)

Prerequisite: ENES100; or permission of ENGR-A. James Clark School of Engineering. Restriction: Must be in the International Engineering Minor. Credit only granted for: ENES458M or ENES474. Formerly: ENES458M.

Faculty supervised research on aspects of engineering in a foreign country including leading fields of research, key world markets, and the culture of the engineering workplace. Students will produce a comprehensive report exhibiting their expertise in their chosen country and the field of engineering within.

ENES 478 Topics in Engineering Education (1 credits)

Restriction: Must be in the Engineering Teaching Fellow program. Repeatable to 3 credits if content differs.

Topics related to teaching engineering courses, particularly project-based courses. Topics can include learning styles, student development theory, multicultural issues in teaching, facilitating team experiences, assessment, and academic integrity.

ENES 480 Engineering Honors Seminar I (1 credits)

Restriction: Must be in College of Engineering Honors; and junior standing or higher.

Introduction to engineering leadership, professionalism, and ethics. Discussions of leadership style, elements of success, professional communication, codes of ethics, handling of ethical dilemmas, and the characteristics of a professional.

ENES 481 Engineering Honors Seminar II (1 credits)

Restriction: Must be in College of Engineering Honors; and junior standing or higher.

Introduction to engineering creativity and innovation in engineering. Application of methods of creativity to topics in communication, conducting research, and leadership.

ENES 489 Special Topics in Engineering (3-6 credits)

Prerequisite: Permission of ENGR-A. James Clark School of Engineering. Repeatable to 6 credits if content differs.

Special topics in engineering.

ENES 490 Quest Consulting and Innovation Practicum (4 credits)

Prerequisite: ENES390 or BMGT390. Also offered as: BMGT490. Credit only granted for: BMGT490 or ENES490.

Final course in the QUEST Honors Fellows Program three-course curriculum. Based on a team-based consulting project with one of QUEST's professional partners. A project advisor and professional champion supervise each student team. Requires extensive out-of-class work.

ENES 491 Defining Consulting and Innovation Projects (3 credits)

Prerequisite: BMGT190 or ENES190. Restriction: Restricted to QUEST Program (TQMP) students. Also offered as: BMGT491. Credit only granted for: BMGT491, ENES491 or BMGT438D. Formerly: BMGT438D.
Cultivate relationships with new and current corporate partners and prepare project scopes for QUEST's capstone course, BMGT/ENES 490H. Requires independent work communicating with clients and class visits to a variety of potential project sites.

ENES 498 Special Topics in Entrepreneurship (3 credits)

Restriction: Must be in Hinman CEOs Program. Repeatable to 12 credits if content differs.
This entrepreneurship seminar and case study-based course will explore technology entrepreneurship with a focus on leadership, marketing, team-building, and management of new technology ventures and assumes baseline knowledge of entrepreneurship. Students will learn skills needed to succeed as a technology entrepreneur and how to apply best practices for planning, launching, and growing new companies. This course is a requirement of the Hinman CEOs program.

ENES 508 Engineering Professional Development for Teachers (1-6 credits)

Prerequisite: Permission of ENGR-A. James Clark School of Engineering. Restriction: Must not be an engineering major. Repeatable to 6 credits if content differs.
An introduction to the fundamental concepts that underlie engineering and the process that engineers use in solving technological problems and in design work. Problems in experimental analysis are demonstrated through laboratory experiments. The laboratory work provides the basis for introductory design.

ENES 601 Future Faculty Program Seminar I (1 credits)

Restriction: Must be in the Clark School Future Faculty Program.
Introduction to and development of skills necessary to obtain and succeed in a university faculty position. Emphasis on technical writing and effective presentations. Discussion of research diversification, networking, ethics and professionalism.

ENES 602 Future Faculty Program Seminar II (1 credits)

Restriction: Must be in the Clark School Future Faculty Program.
Effective teaching techniques. Basic principles of education and learning. Developing a course; promoting active learning, problem solving and critical thinking; designing exam and assignments; and communicating effectively with students.

ENES 603 Future Faculty Program Seminar III (1 credits)

Restriction: Must be in the Clark School Future Faculty Program.
Developing a successful faculty research program. Establishing and maintaining a research group. Finding funding opportunities and writing grant proposals. Mentoring graduate students. Faculty position application process. Preparing research and teaching statements.

ENES 604 Future Faculty Program Teaching Practicum (1 credits)

Prerequisite: ENES602. Restriction: Must be a graduate student in the Clark School Future Faculty Program; and students for whom English is not the native language must pass the Maryland English Institute ITA Evaluation prior to enrolling in this course.
Graduate students will co-teach a course under supervision of a faculty mentor. Graudate students will be involved in all aspects of the course including development of syllabus, presenting lectures, writing and grading examiniations, and evaluating the students in the course.

ENES 658 Special Topics in Engineering in a Global Context (1-3 credits)

Restriction: Graduate standing or permission of instructor. Repeatable to 12 credits if content differs.
Advanced topics in engineering in a global context.

ENES 662 Innovative Ideas and Concept Development (3 credits)

Enables aspiring entrepreneurs to understand the content, methods, and models for new venture opportunity assessment and analysis. Focuses on how to identify and analyze entrepreneurial opportunities for technology-based ventures by first understanding the personal self and decision-making factors. Explores how to evaluate new venture opportunities and challenges within industries and markets.

ENES 663 Strategies for Managing Innovation (3 credits)

Credit only granted for: ENES663 or ENPM691.
Emphasizes how innovative leaders can use strategic management of innovation and technology to enhance firm performance. It helps students to understand the process of technological change; the ways that firms come up with innovations; the strategies that firms use to benefit from innovation; and the process of formulating technology strategy. It provides frameworks for analyzing key aspects of these industries and teaches students how to apply these frameworks.

ENES 664 Business Modeling and Customer Validation (3 credits)

Focuses on how to create and deliver value for customers and extract value for the new venture. Develop business models that encompass the product or service, customers, and the economic engine to meet the venture's financial and growth objectives. Introduces a structured way to think about, analyze, and develop a sound business model that is customer validated.

ENES 665 Innovative Thinking (3 credits)

Introduces students to new and powerful tools to boost their creative problem solving skills. Participants re-discover their communication and teaming skills. Students unlock their creativity potential, and explore win-win approaches to define and solve problems of different kinds. Students are also introduced to topics related to intellectual property.

ENES 666 Creative Design, Prototyping, and Testing (3 credits)

Transition from creative, innovative, design thinking methods to prototyping and concept testing of products and services. Learn how to translate ideas into marketable offerings to create real value for customers and the new venture. Emphasis is placed on an integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design, and the business of new product development. Topics include design methods, modeling and simulation, material and manufacturing process selection, platform and modular design, mass customization, planning and scheduling, and business issues, teamwork, group dynamics, creativity, and innovation.

ENES 667 Market Development and Commercialization (3 credits)

Provides an orientation to key marketing concepts critical to marketing technology-based products and services. Learn to identify market opportunities, understand customer preferences, evaluate market acceptance, and devise the appropriate going to market strategies for the new venture.

ENES 668 Corporate Technology Entrepreneurship (3 credits)
Credit only granted for: ENPM 808N or ENES 668. Formerly: ENPM 808N.
Focuses on the role of entrepreneurial individuals inside of existing technology organizations. Explores developing and leading innovation inside the firm. Discusses stages of innovation in the corporate entrepreneurship process and dynamics of organizational structure, politics, decisions, financing, and personal styles.

ENES 670 Financial Management and New Venture Financing (3 credits)
Provides the essential tools and skills to build a strong financial foundation for a new technology venture. Examines accounting principles as well as methods for keeping firm financial control of the venture. Discusses navigating the multitude of financial barriers that may block entrepreneurial success, as well as how to raise the right amount of capital at the right time from the right source.

ENES 671 Legal Aspects of Entrepreneurship (3 credits)
Explores critical legal and business issues entrepreneurs face as they build and launch a new venture. Examines real world scenarios, and addresses the legal issues at all of the important junctures along the path to success. Significant attention placed on new venture formation, intellectual property management, and financing arrangements.

ENES 672 Launching Technology Startup Ventures (6 credits)
Credit only granted for: ENES660 or ENES672.
Explores the processes and skills needed to launch and manage technology startup ventures. Learn how to apply best practices for planning, launching, and leading new companies. Discusses a wide range of issues of importance and concern to entrepreneurs, to include how to navigate uncertainty.

Engineering, Fire Protection (ENFP)

ENFP 405 Structural Fire Protection (3 credits)
Prerequisite: ENES220. Restriction: Must be in Engineering: Fire Protection program; and permission of ENGR-Fire Protection Engineering department.
Effects of elevated temperature on structural materials; steel, concrete, wood, gypsum, glass and reinforced plastics. Experimental evaluation of fire resistance of building assemblies. Analytical methods to evaluate fire resistance of structural members.

ENFP 410 Advanced Fire Suppression (3 credits)
Prerequisite: ENFP310 and ENFP312. Restriction: Permission of ENGR-Fire Protection Engineering department. Credit only granted for: ENFP 410, ENFP489L, ENFP 653, or ENFP629C.
Analysis of application and theory of fire suppression systems. The key elements of fire suppression systems will be discussed along with how they interact for effective fire suppression design. Physical mechanisms for a variety of fire suppression approaches will be discussed including hose streams, sprinklers, water mist, foam, clean agents, and chemical agents.

ENFP 411 Risk-Informed Performance Based Design (3 credits)
Restriction: Senior standing; or permission of ENGR-Fire Protection Engineering department.
Appraisal and measurement of fire safety. Application of systems analysis, probability theory, engineering economy and risk management in the identification and synthesis of components of fire protection engineering. Methods for the development of criteria for the design, evaluation and assessment of fire safety or component hazards.

ENFP 413 Advanced Life Safety Analysis (3 credits)
Prerequisite: ENFP250. Restriction: Permission of ENGR-Fire Protection Engineering department. Also offered as: ENFP613. Credit only granted for: ENFP413 or ENFP613.
Fractional effective dose (FED) methods for predicting time to incapacitation and death of fires for use in fire safety calculations. Physiology and toxicology of the fire effluent components, decomposition chemistry of common materials, standard experimental approaches. Predictive models of material production rates. People movement characteristics related to building evacuation. Formulation and application of evacuation models. Human behavior factors affecting response of people to fire situations.

ENFP 415 Fire Dynamics (3 credits)
Prerequisite: ENFP312. Restriction: Permission of ENGR-Fire Protection Engineering department. Also offered as: ENFP651. Credit only granted for: ENFP415 or ENFP651.
Introduction to premixed and diffusion flames; ignition, flame spread and rate of burning; fire plumes; flame radiation.

ENFP 425 Enclosure Fire Modeling (3 credits)
Prerequisite: ENES232, ENFP300, and ENFP312. Restriction: Must be in Engineering: Fire Protection program; and senior standing; and permission of ENGR-Fire Protection Engineering department.
An introduction to enclosure fire dynamics through the development of fire modeling algorithms and the application of computer-based fire modeling techniques. The objectives of the course are: to provide a basic understanding of enclosure fire dynamics with an emphasis on a system-level viewpoint (i.e., a global description of the coupling between combustion dynamics, smoke filling, vent flows and heat transfer); and to provide an introduction to the zone modeling approach. Topics covered include a review of the mathematical formulation of zone models, a discussion of numerical integration of the zone modeling equations (using MATLAB), and an introduction to zone modeling software used by professional engineers (e.g., CFAST).

ENFP 426 Computational Methods in Fire Protection (3 credits)
Prerequisite: ENFP425. Restriction: Permission of ENGR-Fire Protection Engineering department. Credit only granted for: ENFP426 or ENFP416.
Introduction to computer-based fire modeling: zone modeling and Computational Fluid Dynamics (CFD); documentation of input data, validation and verification tests.

ENFP 429 Independent Studies (1-3 credits)
Prerequisite: Permission of ENGR-Fire Protection Engineering department. Restriction: Must be in Engineering: Fire Protection program. Repeatable to 6 credits if content differs.
For students who have definite plans for individual study of approved problems, or study of an advanced topic selected in conjunction with the faculty.

ENFP 435 Product Liability and Regulation (3 credits)
Restriction: Junior standing or higher.
Key topics include, biotechnology, safety regulation, federal preemption, product liability, professional negligence, antitrust, privacy and information technology, risk modeling, environmental protection, patent, copyright, trade secrets, reverse engineering, scientific and technological evidence, international trade, engineering ethics. Examples include plane crashes, computer chip protection, human machine interfaces, nuclear power plants, internet censorship, flood control, earthquakes and biomedical technology.

ENFP 440 Smoke Management and Fire Alarm Systems (3 credits)
Prerequisite: ENFP300. Restriction: Permission of ENGR-Fire Protection

Engineering department. Also offered as: ENFP627. Credit only granted for: ENFP440 or ENFP627.
Analysis of hazard posed by smoke in buildings. Performance characteristics of smoke management systems. Review of analytical design aids. Functional analysis and design of fire detection and alerting systems. Examination and evaluation of code criteria, performance specifications and research.

ENFP 489 Special Topics (3 credits)

Prerequisite: Permission of ENGR-Fire Protection Engineering department. Repeatable to 6 credits.
Selected topics of current importance to fire protection.

ENFP 610 Reliability and Risk Analysis in Fire Protection Engineering (3 credits)

Prerequisite: ENFP411.
Reliability engineering analysis techniques in fire protection engineering problems. Computer models, probability distribution theory and Monte Carlo methods.

ENFP 611 Fire Induced Flows (3 credits)

Prerequisite: ENFP415.
Theoretical basis is presented for fire induced bouyancy driven flows. Plumes, ceiling jets, vent flows, compartment flows. Dimensional analysis for correlations and scale model applications. Smoke movement and combustion products.

ENFP 613 Human Response to Fire (3 credits)

Prerequisite: Permission of ENGR-Fire Protection Engineering department. Also offered as: ENFP413.
Fractional effective dose (FED) methods for predicting time to incapacitation and death of fires for use in fire safety engineering calculations. Physiology and toxicology of fire effluent components, decomposition chemistry of common materials, standard experimental approaches. Predictive models of material production rates. People movement characteristics related to building evacuation. Formulation and application of evacuation models. Human behavior factors affecting response of people to fire situations.

ENFP 619 Graduate Seminar (1-3 credits)

Prerequisite: Permission of ENGR-Fire Protection Engineering department. Restriction: Must be in ENGR: MS Only-Fire Protection Engineering (Master's) program. Repeatable to 3 credits.

ENFP 620 Fire Dynamics Laboratory (3 credits)

Recommended: ENFP415.
Laboratory experiments are designed to illustrate fire phenomena and test theoretical models. Diffusion flames, ignition and flame spread on solids, liquid pool fires, wood crib fires, fire plumes, compartment fires.

ENFP 621 Analytical Procedures of Structural Fire Protection (3 credits)

Prerequisite: ENFP405 and ENFP312.
Analysis procedures for structural components of wood, steel, concrete, composites. Structural capabilities, modifications under fire induced exposures. Calculations, computer models for predicting fire resistance ratings of structural components.

ENFP 625 Advanced Fire Modeling (3 credits)

Prerequisite: Permission of ENGR-Fire Protection Engineering department.
Validity, utility, reliability of current computer models. Applications of models in risk assessment, underwriting, loss prediction, hazard analysis. Development and validation of specific application models.

ENFP 627 Smoke Detection and Management (3 credits)

Prerequisite: ENFP300. Also offered as: ENFP440. Credit only granted for: ENFP627 or ENFP440.
Analysis of hazard smoke. Response analysis of smoke detectors based on characteristics of detectors and properties of smoke. Performance characteristics and limitations of smoke management systems. Capabilities and limitations of analytical design aids.

ENFP 629 Selected Topics (3-6 credits)

Prerequisite: Permission of ENGR-Fire Protection Engineering department. Restriction: Must be in ENGR: MS Only-Fire Protection Engineering (Master's) program. Repeatable to 6 credits.
Current research, studies in fire protection engineering. Future trends and significant changes in research, professional areas. The professional standards process.

ENFP 630 Diffusion Flames and Burning Rate Theory (3 credits)

Basic principles of diffusion flames for gaseous, liquid, and solid fuels. Droplet burning, B number, jet combustion, boundary layer combustion, generalized methods.

ENFP 649 Special Problems (1-3 credits)

Restriction: Must be in ENGR: MS Only-Fire Protection Engineering (Master's) program; and permission of instructor; and permission of ENGR-Fire Protection Engineering department. Repeatable to 6 credits if content differs.
Advanced topics selected by the faculty from the current literature to suit the special needs and background of students, or for individual students who have definite plans of individual study.

ENFP 651 Advanced Fire Dynamics (3 credits)

Credit only granted for: ENFP629A or ENFP651. Formerly: ENFP629A.
A review of the basic chemistry and physics necessary to understanding fire dynamics; and of the physics of heat transfer and turbulent fluid flow will be given. The nature and structure of premixed and diffusion flames will be presented.

ENFP 652 Fire Assessment Methods (3 credits)

Credit only granted for: ENFP629B or ENFP652. Formerly: ENFP629B.
This on-line course offers a comprehensive review of experimental techniques to assess fire performance characteristics of materials, products and assemblies.

ENFP 653 Advanced Fire Supression (3 credits)

Restriction: Permission of ENGR-Fire Protection Engineering department. Credit only granted for: ENFP410, ENFP489L, ENFP653, or ENFP629C. Formerly: ENFP629C.
Issues related to the suppression of fires and the design of fire suppression systems. Theoretical aspects of fire suppression and extinction are considered to provide the foundation for the practical design of different types of fire suppression systems. Focus on water-based and "clean agent" fire suppression systems, with emphasis on high challenge and special hazard applications. Systems using other agents are introduced, but are not addressed in detail.

ENFP 661 Forensic Fire Analysis (3 credits)

Credit only granted for: ENFP629D or ENFP661. Formerly: ENFP629D.
This on-line course addresses the forensic analysis of structural fire incidents in terms of enclosure fire dynamics and the impact of fire safety subsystems used to prevent or mitigate the consequences of fire. These subsystems include: ignition prevention, material flammability and flame spread, fire detection and alarm, fire suppression, smoke movement and management, structural fire protection and egress systems. Failures in these subsystems are addressed in terms of differences between expected and observed performance.

ENFP 662 Performance Based Design (3 credits)

Credit only granted for: ENFP629E or ENFP662. Formerly: ENFP629E.
This on-line course demonstrates how fire science can be used to solve fire protection problems in the built environment and will provide an understanding of their performance-based design process, deterministic and risk-based analysis techniques, development of design fire scenarios, trial design development and analysis, and building lifecycle management.

ENFP 663 Advanced Fire Risk Modeling (3 credits)
Credit only granted for: ENFP629R or ENFP663. Formerly: ENFP629R.
This on-line course addresses the fundamentals of fire risk modeling from both theoretical and applied perspectives.

ENFP 799 Master's Thesis Research (1-6 credits)
Prerequisite: Permission of ENGR-Fire Protection Engineering department. Recommended: Completion of ENFP graduate requirements. Repeatable to 6 credits.
Development and completion of Master's Thesis.

English (ENGL)

ENGL 402 Chaucer (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Works read in Middle English. Readings may include Canterbury Tales, Troilus and Criseyde, dream visions, lyrics.

ENGL 403 Shakespeare: The Early Works (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Close study of selected works from the first half of Shakespeare's career. Generic issues of early histories, comedies, tragedies. Language, theme, dramatic technique, sources, and early modern English social-historical context.

ENGL 404 Shakespeare: The Later Works (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Close study of selected plays from the second half of Shakespeare's career. Generic issues of later tragedies, later comedies, romances. Language, theme, dramatic technique, sources, and early modern English social-historical context.

ENGL 407 Non-dramatic Literature of the Sixteenth Century (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Poetic and prose genres--utopia, epic, narrative, lyric, sonnet, oration, epistle, sermon, apologia--in context of the literary and intellectual life of the sixteenth century. Writers such as More, Wyatt, Surrey, Sidney, and Spenser.

ENGL 408 Literature by Women Before 1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs. Also offered as: WMST408. Credit only granted for: ENGL408 or WMST408.
Selected writings by women in the medieval and early modern era.

ENGL 409 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

ENGL 410 Edmund Spenser (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Selected works of Edmund Spenser in their literary, social, and historical contexts. Special attention to The Faerie Queene; also sonnets and lyric poetry.

ENGL 412 Literature of the Seventeenth Century, 1600-1660 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Works from early Stuart through Interregnum period. Major literary genres in historical contexts. Writers such as Donne, Jonson, Mary Wroth, Bacon, Browne, and Marvell.

ENGL 414 Milton (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Poetry and major prose in their social, political, and literary-historical contexts. Special attention to Paradise Lost. Other works may include Samson Agonistes and shorter poems.

ENGL 415 Literature of the Seventeenth Century, 1660-1700 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
English poetry, drama, fiction, and non-fiction written from the Restoration of Charles II to 1700. Attention to increasing literacy and publication and greater involvement by women in literary production. Authors include Milton, Dryden, Congreve, and Behn.

ENGL 416 Literature of the Eighteenth Century, 1700-1750 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
British literary traditions, including the poetry of Pope, the prose of Swift, the correspondence of Montagu, the drama of Gay, and early novels by Defoe, Richardson, and Fielding.

ENGL 417 Literature of the Eighteenth Century, 1750-1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
British poetry, drama, fiction, and nonfiction, emphasizing innovative forms and attitudes in genres such as the gothic novel and political writings, as well as more traditional works. Authors include Johnson, Burney, Sterne, Burke, and Wollstonecraft.

ENGL 418 Major British Writers before 1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.
Two writers studied intensively each semester.

ENGL 419 Major British Writers after 1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.
Two writers studied intensively each semester.

ENGL 420 English Romantic Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
British poetry, drama, fiction, and criticism c.1790 to c.1830, a period of dramatic social change and revolution in literature, philosophy, the arts, industry, and politics. Authors include Austen, Wordsworth, Coleridge, Keats, Byron, Percy, and Mary Shelley.

ENGL 422 English Victorian Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
A survey of English literature of the Victorian period. Writers may include Arnold, Browning, Tennyson, Dickens, George Eliot, Carlyle, Ruskin, Newman, and Wilde.

ENGL 425 Modern British Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Major Modernist writers in English prose and poetry since 1900. Such writers as Eliot, Larkin, Forster, Burgess, Durrell, Henry Green, Golding, Auden, Malcolm Lowry, Joyce, and Yeats.

ENGL 428 Seminar in Language and Literature (3 credits)
Restriction: Junior standing or higher; and must be in English Language and Literature program. Repeatable to 9 credits if content differs.
Topics will vary each semester. The course will provide a seminar experience in material or methodologies not otherwise available to the major.

ENGL 429 Independent Research in English (1-6 credits)
Prerequisite: ENGL301; and two English courses (excluding fundamental studies requirement); and permission of ARHU-English department. Restriction: Sophomore standing or higher. Repeatable to 9 credits if content differs.
An advanced independent research project for qualified students, supervised by an English faculty member, on a topic not ordinarily covered in available courses.

ENGL 430 American Literature, Beginning to 1810, the Colonial and Federal Periods (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Puritanism, the Enlightenment, early Romanticism. Writers such as Bradstreet, Franklin, Brown.

ENGL 431 American Literature: 1810 to 1865, the American Renaissance (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Nationalism, Sentimentalism, Transcendentalism. Writers such as Douglass, Stowe, Melville.

ENGL 432 American Literature: 1865 to 1914, Realism and Naturalism (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Reconstruction, Realism, Naturalism. Representative writers such as Dickinson, James, Dreiser.

ENGL 433 American Literature: 1914 to the Present, the Modern Period (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Modernism, Postmodernism. Writers such as Stevens, Stein, Ellison.

ENGL 434 American Drama (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
American drama from late eighteenth-century to the present; emphasis on theater of the twentieth century. Authors such as Tyler, O'Neill, Hellman, Hansberry, and Albee.

ENGL 435 American Poetry: Beginning to the Present (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Selections of American poetry, from Bradstreet to contemporary free verse. Authors such as Whitman, Dickinson, Bishop, Hughes, Rich, and Frost.

ENGL 437 Contemporary American Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Prose, poetry, drama of living American writers. Current cultural and social issues.

ENGL 438 Major American Writers before 1865 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.
Two writers studied intensively each semester.

ENGL 439 Major American Writers after 1865 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.
Two writers studied intensively each semester.

ENGL 440 The Novel in America to 1914 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Survey of the American novel to World War I. Cultural and philosophical contexts; technical developments in the genre. Authors such as Melville, Wells Brown, James, Sedgwick, Chopin.

ENGL 441 The Novel in America Since 1914 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Survey of the American novel since World War I. Cultural and philosophical contexts, technical developments in the genre. Authors such as Hemingway, Cather, Faulkner, Anne Tyler, Morrison.

ENGL 442 Literature of the South (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Survey of fiction and poetry, especially the period 1900 to the present. Authors such as Faulkner, Welty, Glasgow, Wolfe, and Hurston.

ENGL 444 Feminist Critical Theory (3 credits)
Prerequisite: WMST200, WMST250, or ENGL250. Also offered as: WMST444. Credit only granted for: ENGL444 or WMST444.
Issues in contemporary feminist thought that have particular relevance to textual studies, such as theories of language, literature, culture, interpretation, and identity.

ENGL 445 Modern British and American Poetry (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
The formation of Modernism in British and American poetry before 1930. Such poets as Yeats, Pound, H.D., Eliot, Langston Hughes, Moore, Stevens, and Williams.

ENGL 446 Post-Modern British and American Poetry (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
British and American poets from the 1930s to the present. Such poets as Auden, Williams, Plath, Brooks, Lowell, Wolcott, Ted Hughes, Bishop, Larkin, Jarrell, and Berryman.

ENGL 447 Satire (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
An introduction to English and American satire from Chaucer to the present.

ENGL 448 Literature by Women of Color (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs. Also offered as: WMST448. Credit only granted for: ENGL448 or WMST448.
Literature by women of color in the United

States, Britain, and in colonial and post-colonial countries.

ENGL 449 Selected Topics in U.S. Latina/o Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs. Credit only granted for: ENGL449 or ENGL479F.
Study of selected works by U.S. Latina/o writers.

ENGL 450 Renaissance Drama I (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Drama of the sixteenth century, from Sir Thomas More's circle through Lyly, Greene, Marlowe, and their successors. Interludes, school drama, comedy and tragedy, professional theater. Influences of humanism, Protestantism, politics, and cultural change.

ENGL 451 Renaissance Drama II (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Drama in early decades of the seventeenth century. Playwrights include Jonson, Middleton, Marston, Webster, Beaumont and Fletcher. Tragedy, city comedy, tragicomedy, satire, masque. Pre-Civil War theatrical, political, and religious contexts.

ENGL 452 English Drama From 1660 to 1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Restoration and eighteenth-century drama, with special attention to theater history, cultural influences, concepts of tragedy, comedy, farce, parody, and burlesque, as well as dramatic and verbal wit.

ENGL 453 Literary Theory (3 credits)
Prerequisite: Two courses in literature; or permission of ARHU-English department.
An in-depth study of literary and critical theory.

ENGL 454 Modern Drama (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
The roots of European Modernism and its manifestation in the drama of the twentieth century. Such playwrights as Beckett, Churchill, Stoppard, Wilde, Chekhov, Ibsen, Brecht, O'Neill, Sartre, Anouilh, Williams, and Shaw.

ENGL 455 The Eighteenth-Century English Novel (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
The origins and development of the British novel, from the late seventeenth century until the beginning of the nineteenth. Questions about what novels were, who wrote them, and who read them. Authors such as Behn, Defoe, Richardson, Fielding, Sterne, Smollett, Burney, Radcliffe, and Austen.

ENGL 456 The Nineteenth-Century English Novel (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Surveys major novels of the period. Attention to narrative form and realism; representations of gender and class; social contexts for reading, writing and publishing. Authors such as Austen, Bronte, Dickens, George Eliot, Trollope.

ENGL 457 The Modern Novel (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Modernism in the novel of the twentieth century. Such writers as Joyce, Lawrence, Murdoch, James, Forster, Faulkner, Hemingway, Fitzgerald, Ellison, Welty, Nabokov and Malamud.

ENGL 458 Literature by Women after 1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs. Also offered as: WMST458. Credit only granted for: ENGL458 or WMST458.
Selected writings by women after 1800.

ENGL 459 Selected Topics in Sexuality and Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.
Detailed study of sexuality as an aspect of literary and cultural expression.

ENGL 462 Folksong and Ballad (3 credits)
A cross-section of American folk and popular songs in their cultural contexts; artists from Bill Monroe to Robert Johnson.

ENGL 465 Theories of Sexuality and Literature (3 credits)
Prerequisite: Two lower-level English courses, at least one in literature; or permission of ARHU-English department. Also offered as: LGBT465. Credit only granted for: ENGL465 or LGBT465.
An in-depth study of the ways in which sexuality and sexual difference create or confound the conditions of meaning in the production of literary texts. Attention to psychoanalysis, history of sexuality, feminist theory, and other accounts of sexual identity.

ENGL 466 Arthurian Legend (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Development of Arthurian legend in English and continental literature from Middle Ages to twentieth century. All readings in modern English.

ENGL 467 Computer and Text (3 credits)
Prerequisite: One English course in literature; or permission of ARHU-English department.
Examines electronic literature and other aspects of digital textuality. Topics may include interactive fiction, hypertext, image and sound works, literary games and simulations. Emphasis on critical and theoretical approaches rather than design or programming.

ENGL 468 Selected Topics in Film Studies (3-9 credits)
Prerequisite: ENGL245, FILM245, FILM283, or SLLC283; or permission of ARHU-English department. Recommended: ENGL329, CMLT280, and ENGL245. Repeatable to 9 credits if content differs. Credit only granted for: ENGL468, ENGL479E-Spr 2008, ENGL479F-Spr 2009, ENGL479G-Fall 2008, or ENGL479M-Fall 2009/Fall 2010.
Advanced studies in various periods and genres of film.

ENGL 470 African-American Literature: The Beginning to 1910 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Beginnings of African-American literature including origins of literary expression in folk tales, songs, and spirituals; slave narratives; pamphlets, essays and oratory; and the emergence of poetry and fiction. Emphasis is on interaction between literary forms and the salient political issues of the day.

ENGL 471 African-American Literature: 1910-1945 (3 credits)

Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Emergence of modernism in African-American writing including debates over the definition of unique African-American aesthetics, with emphasis on conditions surrounding the production of African-American literatures.

ENGL 472 African-American Literature: 1945 to Present (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Transformation of African-American literatures into modern and postmodern forms. Influenced by World War II and the Civil Rights and Black Power movements, this literature is characterized by conscious attempts to reconnect literary and folk forms, the emergence of women writers, and highly experimental fiction.

ENGL 475 Postmodern Literature (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
The origins and ongoing development of postmodern literature. Aspects of the "postmodern condition," such as the collapse of identity, the erasure of cultural and aesthetic boundaries, and the dissolution of life into textuality. The novel and other genres and media.

ENGL 477 Studies in Mythmaking (3 credits)
Prerequisite: Two literature courses.
Major themes, figures, and configurations of northern European mythology, examining the value of the mythic mode of thought in a scientific era.

ENGL 478 Selected Topics in English and American Literature before 1800 (1-3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.

ENGL 479 Selected Topics in English and American Literature after 1800 (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department. Repeatable to 9 credits if content differs.

ENGL 482 History of the English Language (3 credits)
Prerequisite: ENGL280 or LING200; or permission of ARHU-English department.
Origin and development of the English language.

ENGL 483 American English (3 credits)
Prerequisite: LING200 or ENGL280; or permission of ARHU-English department.
Origins and development of the various dialects of English spoken in the United States.

ENGL 484 Advanced English Grammar (3 credits)
Credit only granted for: ENGL484 or LING402.
Advanced study of grammatical description.

ENGL 486 Introduction to Old English (3 credits)
Prerequisite: Two English courses in literature; or permission of ARHU-English department.
Grammar, syntax, and phonology of Old English. Works read in the original language. Poetry may include "Battle of Maldon," "Dream of the Rood," "Wanderer," "Seafarer," riddles; prose of Bede, Wulfstan, Aelfric, and other writers of Anglo-Saxon period in England.

ENGL 487 Foundations of Rhetoric (3 credits)
Credit only granted for: ENGL487 or COMM401.
Principles and approaches to the theory, criticism, and historical understanding of rhetorical discourse.

ENGL 488 Topics in Advanced Writing (3 credits)
Repeatable to 9 credits if content differs.
Different genres of technical and professional writing including proposal writing, computer documentation, technical report writing, instruction manuals, etc. Students will analyze models of a genre, produce their own versions, test, edit and revise them.

ENGL 489 Special Topics in English Language (3 credits)
Repeatable to 9 credits if content differs.
Current topics in language, such as linguistics, history of rhetoric, and composition studies.

ENGL 493 Advanced Writing Theory and Practice (3 credits)
Recommended: Satisfactory completion of professional writing requirement. Restriction: Must have earned a minimum of 60 credits.
Traditional and contemporary approaches to rhetoric and writing theory for advanced writing students who wish to develop their abilities to analyze and produce written texts in professional, public, digital, and/or advanced academic contexts.

ENGL 494 Editing and Document Design (3 credits)
Prerequisite: ENGL393 or ENGL391; or students who have taken courses with comparable content may contact the department.
Principles of general editing for clarity, precision and correctness. Applications of the conventions of grammar, spelling, punctuation and usage, and organization for logic and accuracy. Working knowledge of the professional vocabulary of editing applied throughout the course.

ENGL 495 Independent Study in Honors (1-3 credits)
Prerequisite: ENGL373 and ENGL370. Restriction: Must be in English Language and Literature program; and candidacy for honors in English.
Completion and presentation of the senior honors project.

ENGL 498 Advanced Fiction Workshop (3 credits)
Prerequisite: ENGL352; or permission of ARHU-English department. Repeatable to 9 credits if content differs. Formerly: ENGL496.
An advanced class in the making of fiction. Intensive discussion of students' own fiction. Readings include both fiction and essays about fiction by practicing writers. Writing short critical papers, responding to works of fiction, and to colleagues' fiction, in-class writing exercises, intensive reading, and thinking about literature, in equal parts, and attendance at readings.

ENGL 499 Advanced Poetry Workshop (3 credits)
Prerequisite: ENGL353; or permission of ARHU-English department. Repeatable to 9 credits if content differs. Formerly: ENGL497.
An advanced class in the making of poetry. Intensive discussion of students' own poems. Readings include both poetry and essays about poetry by practicing poets. Writing short critical prose pieces, responding critically to colleagues' poems, in-class and outside writing exercises, and attendance at poetry readings.

ENGL 601 Literary Research and Critical Contexts (3 credits)

ENGL 602 Critical Theory and Literary Criticism (3 credits)
An introduction to critical theory and literary criticism, with an overview of major movements (including formalism, structuralism and poststructuralism, Marxism, psychoanalysis, and feminism). Designed to help graduate students assess the various ways of approaching and writing about literature.

ENGL 604 Old English (3 credits)

Grammar, syntax, phonology and prosody of Old English. Designed to give graduate students a working knowledge of Old English and to introduce them to the major Old English texts in the original.

ENGL 607 Readings in the History of Rhetorical Theory to 1900 (3 credits)
Earlier theories of effective written discourse surveyed historically and as influenced by ethical, technical, and social change.

ENGL 609 Technologies of Writing (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 9 credits if content differs. Additional information: May fulfill a requirement for the MA in English with a Concentration in Rhetoric and Composition.
ENGL 609 - Technologies of Writing: Readings in the technologies of writing systems, print, and new media.

ENGL 611 Approaches to College Composition (3 credits)
Prerequisite: Permission of ARHU-English department. Additional information: Required for graduate assistants (optional to other graduate students).
A seminar emphasizing rhetorical and linguistic foundations for the handling of a course in freshman composition.

ENGL 612 Approaches to Professional and Technical Writing (3 credits)
A pedagogical approach to professional and technical writing, its history and methodolgy.

ENGL 618 Writing for Professionals (3 credits)
Repeatable to 9 credits if content differs.
Writing proposals, reports, manuals, policy statements, correspondence, etc. for typical government and business settings. Principles of rhetorical and linguistic analysis and techniques for managing the review process in large organizations.

ENGL 619 Readings in Linguistics (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 9 credits if content differs.
A survey of theoretical and applied linguistics.

ENGL 620 Readings in Medieval English Literature (3 credits)

ENGL 621 Readings in Renaissance English Literature (3 credits)

ENGL 622 Readings in Seventeenth-Century English Literature (3 credits)

ENGL 623 Readings in Eighteenth-Century English Literature (3 credits)

ENGL 624 Readings in English Romantic Literature (3 credits)

ENGL 625 Readings in English Victorian Literature (3 credits)

ENGL 626 Readings in American Literature before 1865 (3 credits)

ENGL 627 Readings in American Literature, 1865-1914 (3 credits)

ENGL 628 Readings in African American Literature (3 credits)

ENGL 629 Readings in Folklore, Folklife, and Myth (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 6.0 credits if content differs.
Readings pertaining to various genres of folklore and myth such as oral narrative, epic poetry, ballad, folksong, belief, custom and material culture, with special attention given to the history of the study of folklore including fieldwork, interpretation and the political application of these materials. Explores issues of ethnicity, geography, religion, race, gender, and class, as well as the ongoing relations between orality, literacy, print, and other media.

ENGL 630 Readings in 20th Century English Literature (3 credits)

ENGL 631 Readings in 20th Century American Literature (3 credits)

ENGL 638 Readings in Film as Text and Cultural Form (3 credits)
Repeatable to 6 credits if content differs.
An inquiry into theoretical approaches to the cinematic text that include studies of form, culture, reception, ideological formations, historical contextualizations, and the problematics of representation.

ENGL 648 Contemporary American Literature (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 9 credits.
A survey of American literature in the 21st Century.

ENGL 649 Readings in Rhetoric, Composition, and Literacy (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 9 credits if content differs. Additional information: May fulfill requirement for MA in English with a Concentration in Rhetoric and Composition.
Readings in Rhetoric, Composition, and Literacy. Special Topics in the theory and research of rhetoric, composition, and literacy

ENGL 659 Readings in Postcolonial Literatures and Theory (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 6 credits if content differs.
Readings in post-colonial, diasporic, and trans-national theory and literature.

ENGL 668 Readings in Modern Literary Theory (3-6 credits)
Formerly: ENGL666.

ENGL 679 Professional and Career Mentoring for Master's Students (1-3 credits)
Repeatable to 6 credits if content differs.
Augments advising currently provided by the English Department Graduate Studies Office. Individual professional and career mentoring for MA and MFA students from a faculty member.

ENGL 688 Poetry Workshop (3 credits)
Prerequisite: Permission of ARHU-English department.
Poetry workshop.

ENGL 689 Fiction Workshop (3 credits)
Prerequisite: Permission of ARHU-English department.
Fiction workshop.

ENGL 699 Independent Study (1-3 credits)
Restriction: Permission of instructor; and departmental approval of research project.

ENGL 701 Paradigms of Theory (3 credits)
Exploration of the works of four or five

major critical thinkers who underwrite the study of theory in the academy today, with special attention to the diversity within critical theory.

ENGL 702 Cultures of Theory (3 credits)
Prerequisite: An introductory course in critical theory.
An exploration of the socio-historic, material, and cultural contexts of various theoretical practices and traditions.

ENGL 708 Seminar in Rhetoric (3 credits)
Repeatable to 9 credits if content differs.
Topics in rhetoric: history of rhetorical theory, modern rhetorical theory, rhetorical interpretation, composition theory, rhetoric of social groups.

ENGL 718 Seminar in Medieval Literature (3 credits)

ENGL 719 Seminar in Renaissance Literature (3 credits)

ENGL 728 Seminar in Seventeenth-Century Literature (3 credits)

ENGL 729 Seminar in Eighteenth-Century Literature (3 credits)

ENGL 738 Seminar in Nineteenth-Century Literature (3 credits)

ENGL 739 Seminar in Nineteenth-Century Literature (3 credits)

ENGL 748 Seminar in American Literature (3 credits)

ENGL 749 Studies in Twentieth-Century Literature (3 credits)

ENGL 758 Literary Criticism and Theory (3 credits)

ENGL 759 Seminar in Literature and the Other Arts (3 credits)

ENGL 768 Studies in Genre (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 9 credits if content differs.

ENGL 775 Seminar in Composition Theory (3 credits)
Readings and research in recent theories of effective writing.

ENGL 776 Seminar in Modern Rhetorical Theory (3 credits)
Restriction: Permission of ARHU-English department. Additional information: May fulfill seminar requirements for MA in English with Concentration in Rhetoric and Composition.
Seminar in Modern Rhetorical Theory. Theories and trends in twentieth and twenty-first century rhetorical theory

ENGL 778 Seminar in Folklore and Myth (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 6.0 credits if content differs.

ENGL 779 Seminar in Language Study (3 credits)
Seminar in linguistic aspects of literature and composition.

ENGL 788 Studies in Poetic Form (3 credits)
Repeatable to 9 credits.

ENGL 789 Form and Theory in Fiction (3 credits)
Prerequisite: Permission of ARHU-English department.
A variety of prose modes (mediations, psychological studies, reportage myths, collage, magic realism, satire, etc.). Some of the writers to be read include Kafka, Cather, Barth, Kundera, and Barthelme.

ENGL 798 Critical Theory Colloquium (1 credits)
Prerequisite: A course in critical theory. Repeatable to 10 credits if content differs. Also offered as: CMLT798.
An intensive advanced exploration of current problems and issues in critical theory.

ENGL 799 Master's Thesis Research (1-6 credits)

ENGL 809 Academic Publishing Workshop (1-2 credits)
Restriction: Must be in a major within ARHU-English department; and permission of instructor. Repeatable to 8 credits if content differs. Additional information: Preference will be given to doctoral students beyond coursework.
A workshop for the preparation of articles of other critical writing for publication in academic journals or other professional venues.

ENGL 819 Seminar in Themes and Types in English Literature (3 credits)

ENGL 828 Seminar in Themes and Types in American Literature (3 credits)

ENGL 829 Seminar in Postcolonial Literatures (3 credits)
Restriction: Permission of ARHU-English department. Repeatable to 6 credits if content differs.
Postcolonial, transnational, and diasporic literatures in the Anglophone world.

ENGL 878 Pedagogical Mentoring for Doctoral Students (1-3 credits)
Repeatable to 12 credits if content differs.
Pedagogical mentoring by roster faculty members for graduate students teaching 200-level literature courses.

ENGL 879 Professional Mentoring for Doctoral Students (1-3 credits)
Repeatable to 12 credits if content differs.
Augments advising currently provided by the English Department Graduate Studies Office. Individual professional and career mentoring for PhD students from a faculty member.

ENGL 888 Practicum in English Studies (1 credits)

ENGL 898 Pre-Candidacy Research (1-8 credits)
Repeatable to 12 credits if content differs.
Pedagogical mentoring by roster faculty members for graduate students teaching 200-level literature courses.

ENGL 899 Doctoral Dissertation Research (1-8 credits)

Engineering, Materials (ENMA)

ENMA 410 Materials for Energy I (3 credits)
Prerequisite: Minimum grade of C- in ENMA300; and permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA410 or ENMA489H. Formerly: ENMA 489H.
The goal is to demonstrate the role of materials in solving one of the most critical socio-economic issues of our time,

affordable and sustainable energy. There will be a discussion of U.S. and global energy and related environmental issues. Topics covered include: fuel cells and batteries (electrochemical energy conversion and storage); catalysts and membrane separations (fossil fuel and biomass energy conversion); and nuclear fuels.

ENMA 411 Materials for Energy II (3 credits)

Prerequisite: Minimum grade of C- in ENMA300; and permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA411 or ENMA489I. Formerly: ENMA489I.

Demonstrates the role of materials in solving one of the most critical socio-economic issues of our time, affordable and sustainable energy. Materials for Energy is a two-part course based on material functionality; however, they are independent and neither is a prerequisite for the other. Materials for Energy II will focus on electrical, optical, thermal, and mechanically functional materials for energy devices. Solar cells, solar fuel, solar thermal, energy efficient lighting, building energy, thermoelectric and wind energy will be covered.

ENMA 412 Fundamentals of Photovoltaics (3 credits)

Prerequisite: ENMA300; and permission of ENGR-Materials Science & Engineering department.

Overview of the fundamentals of photovoltaic devices, including principles of operation, with emphasis on the materials science aspects of the different technologies available.

ENMA 420 Intermediate Ceramics (3 credits)

Prerequisite: ENMA300; or permission of ENGR-Materials Science & Engineering department.

To introduce basic concepts such as crystal chemistry, defect chemistry and ternary phase equilibria which can also be used to illustrate the various types of advanced ceramics (superconductors; superionic conductors; dielectrics including ferroelectrics; optical materials; high temperature structural materials; etc.) and allow an understanding of their behaviors.

ENMA 421 Design of Composites (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA421 or ENMA489A. Formerly: ENMA489A.

Fundamentals of design, processing and selection composite materials for structural applications will be covered. The topics include a review of all classes of materials, an in-depth analysis of micro and macro mechanical behavior including interactions at the two-phase interfaces, modeling of composite morphologies for optimal microstructures, material aspects, cost considerations, processing methods including consideration of chemical reactions and stability of the interfaces, and materials selection considerations.

ENMA 422 Radiation Effects of Materials (3 credits)

Prerequisite: ENMA300; and permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA422 or ENMA489E. Formerly: ENMA489E.

Ionizing radiation, radiation dosimetry and sensors, radiation processing, radiation effects on: polymers, metals, semiconductors, liquids, and gases. Radiation in advanced manufacturing, radiation-physical technology.

ENMA 423 Manufacturing with Polymers (3 credits)

Prerequisite: ENMA300; or permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA423 and ENMA489R. Formerly: ENMA489R.

Study of the process of engineering design and development of polymer formulations. Knowledge of commodity polymers and their physical properties, ability to design an extrusion process, develop the economics of a polymer manufacturing process, develop a working knowledge of characterization techniques for determination of physical and mechanical properties of polymers.

ENMA 425 Introduction to Biomaterials (3 credits)

Recommended: ENMA300. Restriction: Permission of ENGR-Materials Science & Engineering department. Also offered as: BIOE453. Credit only granted for: BIOE453, ENMA489W, or ENMA425. Formerly: ENMA489W.

Examination of materials used in humans and other biological systems in terms of the relationships between structure, fundamental properties and functional behavior. Replacement materials such as implants, assistive devices such as insulin pumps and pacemakers, drug delivery systems, biosensors, engineered materials such as artificial skin and bone growth scaffolds, and biocompatibility will be covered.

ENMA 426 Reliability of Materials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA426 or ENMA489R. Formerly: ENMA489R.

Students are taught the basic degradation mechanisms of materials, through the understanding of the physics, chemistry, mechanics of such mechanisms. Mechanical failure mechanisms concentrate on fatigue, and creep. Chemical failure mechanisms emphasize corrosion and oxidation. Physical mechanisms such as diffusion, electromigration, defects and defect migration, surface trapping mechanisms, charge creation and migration are also included.

ENMA 430 Nanosized Materials (3 credits)

Prerequisite: PHYS431 or ENMA460; and (CHEM231 or CHEM481). Credit only granted for: ENMA430 or ENMA489G. Formerly: ENMA489G.

Practical aspects of nanoscale materials fabrication and utilization will be covered. It presents various approaches for the synthesis of nanoparticles, nanowires, and nanotubes, and discusses the unique properties observed in these structures and devices made with them.

ENMA 431 Nanomechanics of Biomaterials (3 credits)

Prerequisite: ENMA300; and permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA431 or ENMA489B. Formerly: ENMA489B.

Focuses on the latest scientific developments and discoveries in the nanoscale structure and properties of biological materials. The course begins with introductory lectures on the various nanostructures of biomaterials, and their physiological roles under mechanical forces. General aspects of biopolymers, protein folding, and self-assembly are also covered. Next, a series of in-depth lectures are presented on the characterization methods of nanomechanical properties using single molecule techniques. Finally, current applications of nanobiomaterials in the area of molecular machines, molecular self-assembly, and nanoscaffold are discussed.

ENMA 440 Nano Plasma Processing of Materials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA440, ENMA489P, ENMA640, or ENMA698P. Formerly: ENMA489P.

Sustaining mechanisms of plasmas are covered, especially low-pressure electrical gas discharges, fundamental plasma physics, sheath formation, electric and magnetic field effects, plasma-surface interactions in chemically reactive systems, plasma diagnostic techniques and selected industrial applications of low pressure plasmas.

ENMA 441 Characterization of Materials (3 credits)

Prerequisite: ENMA300. Restriction: Permission of ENGR-Materials Science & Engineering department; and senior standing. Credit only granted for: ENMA489T or ENMA441. Formerly: ENMA489T.

Techniques to characterize the properties of materials whose characteristic dimensions range from nanometers to macroscopic. These include conventional crystalline and noncrystalline materials, with a special attention to materials of current technological interest. The course will include recent results from the scientific literature.

ENMA 442 Nanomaterials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA442 or ENMA489N. Formerly: ENMA489N.

An exploration of materials whose structure places them at the boundary between small objects and large molecules. Having characteristic dimensions in the range of 1-100 nanometers, these materials are difficult to synthesize and characterize but are nevertheless at the forefront of science and technology in many fields. Also, the methods for creating, manipulating and measuring these materials with an emphasis on the current scientific literature will be covered. The novel properties and potential applications will also be addressed.

ENMA 443 Phontonic Materials, Devices and Reliability (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department; and junior standing or higher. Credit only granted for: ENMA443 or ENMA489Z. Formerly: ENMA489Z.

The course focuses on the understanding of the basic optical processes in semiconductors, dielectrics and organic materials. The application of such materials in systems composed of waveguides, light emitting diodes and lasers, as well as modulators is developed.

ENMA 445 Liquid Crystals and Structured Soft Materials (3 credits)

Prerequisite: MATH246, PHYS270, and PHYS271. Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA445 or ENMA489L. Formerly: ENMA489L.

Elective course on the properties and behavior of liquid crystals and related soft materials, and their relationship to biomaterials and to applications.

ENMA 460 Physics of Solid Materials (3 credits)

Prerequisite: PHYS271, PHYS270, and MATH241. Restriction: Junior standing or higher; and must be in Engineering: Materials Science program. Also offered as: PHYS431. Credit only granted for: ENMA460 or PHYS431.

Classes of materials; introduction to basic ideal and real materials' behavior including mechanical, electrical, thermal, magnetic and optical responses of materials; importance of microstructure in behavior. One application of each property will be discussed in detail.

ENMA 461 Thermodynamics of Materials (3 credits)

Prerequisite: ENMA300. Restriction: Junior standing or higher.

Thermodynamic aspects of materials; basic concepts and their application in design and processing of materials and systems. Topics include: energy, entropy, adiabatic and isothermal processes, internal and free energy, heat capacity, phase equilibria and surfaces and interfaces.

ENMA 462 Smart Materials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA462 or ENMA489B. Formerly: ENMA489B.

A fundamental understanding will be provided as it relates to the following topics: ferroic materials, ferromagnets, ferroelectric materials, shape memory alloys and multiferroic materials that are simultaneously ferromagnetic and ferroelectric. The ferroic properties will be discussed on an atomic, nano- and micro-scales so that actual and potential applications on those scales become clear. Examples of those applications will be presented.

ENMA 463 Macroprocessing of Materials (3 credits)

Prerequisite: ENMA300. Restriction: Junior standing or higher.

Processing of modern, bulk engineering materials. Raw materials, forming, firing, finishing and joining. More emphasis on metals and ceramics than polymers.

ENMA 464 Environmental Effects on Engineering Materials (3 credits)

Prerequisite: ENMA300. Or permission of ENGR-Materials Science & Engineering department; and permission of instructor.

Introduction to the phenomena associated with the resistance of materials to damage under severe environmental conditions. Oxidation, corrosion, stress corrosion, corrosion fatigue and radiation damage are examined from the point of view of mechanism and influence on the properties of materials. Methods of corrosion protection and criteria for selection of materials for use in radiation environments.

ENMA 465 Microprocessing Materials (3 credits)

Prerequisite: ENMA300. Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA363, ENMA489B, or ENMA465. Formerly: ENMA363.

Micro and nanoscale processing of materials. Emphasis on thin film processing for advanced technologies.

ENMA 466 Advanced Materials Fabrication Laboratory (3 credits)

Prerequisite: ENMA465; and permission of ENGR-Materials Science & Engineering department.

This course allows students an opportunity to study advanced materials systems in depth through a combination of lectures and hands-on laboratory experiments. Students will be trained in materials processing and characterization techniques. Each student will fabricate materials and devices in our state-of-the-art nanofabrication clean room facility (Fablab), as well as evaluate them using a variety of characterization techniques.

ENMA 471 Kinetics, Diffusion and Phase Transformations (3 credits)

Prerequisite: Must have completed or be concurrently enrolled in ENMA461. Restriction: Junior standing or higher; or permission of ENGR-Materials Science & Engineering department.

Fundamentals of diffusion, the kinetics of reactions including nucleation and growth and phase transformations in materials.

ENMA 472 Technology and Design of Engineering Materials (3 credits)

Prerequisite: ENMA300.

Relationship between properties of solids and their engineering applications. Criteria for the choice of materials for electronic, mechanical and chemical properties. Particular emphasis on the relationships between the structure of solids and their potential engineering applications.

ENMA 474 Introduction to Computational Materials Science (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA474 or ENMA489A. Formerly: ENMA489A.

This is an introductory course aiming for junior and senior undergraduate students to study atomistic modeling and simulation techniques that are used in materials science. This course covers the theories and applications of atomistic scale modeling techniques to simulate, understand, and predict the properties of materials. Topics include: molecular statics, quantum mechanical methods, molecular dynamics simulations and Monte Carlo simulations.

ENMA 475 Fundamentals of Diffraction Techniques in Materials Science (3 credits)
Prerequisite: MATH246, PHYS270, and PHYS271. Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA475 or ENMA489M. Formerly: ENMA489M.
This course looks at the advanced methods of x-ray scattering/diffraction available thanks to the more powerful sources available to us. The availability of these sources enables us to study liquid crystals, polymers, nanomaterials, quasiorganized materials (including nano) and disordered materials.

ENMA 481 Introduction to Electronic and Optical Materials (3 credits)
Prerequisite: ENMA300; or students who have taken courses with comparable content may contact the department.
Electronic, optical and magnetic properties of materials. Emphasis on materials for advanced optoelectronic and magnetic devices and the relationship between properties and the processing/fabrication conditions.

ENMA 482 Introduction to Electron Microscopy (3 credits)
Prerequisite: PHYS142, PHYS122, or PHYS260. Credit only granted for: ENMA482 or ENMA489J. Formerly: ENMA489J.
An introduction of the basic principles of operation for modern electron microscopes. Details will be given on the construction of microscopes, their basic operation, and the types of questions that can be addressed with an electron microscope. Emphasis will be placed on a conceptual understanding of the underlying theories. Where appropriate, mathematical descriptions will be utilized. Upon completion of this course, students will be excepted to have a basic understanding sufficient to give interpretations of microscopy images and to suggest the correct tool or approach for certain research studies.

ENMA 484 Fundamentals of Finite Element Modeling (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA484 or ENMA489F. Formerly: ENMA489F.
A brief review of mechanical behavior of materials, introduction to Finite Element Modeling (FEM), and procedures for predicting mechanical behavior of materials by FEM using computer software (at present ANSYS). The FEM procedures include, setting up the model, mesh generation, data input and interpretation of the results.

ENMA 489 Selected Topics in Engineering Materials (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Repeatable to 12 credits if content differs.
Selected topics of current importance in materials science and engineering.

ENMA 490 Materials Design (3 credits)
Restriction: Senior standing.
Capstone design course. Students work in teams on projects evaluating a society or industry based materials problem and then design and evaluate a strategy to minimize or eliminate the problem; includes written and oral presentations.

ENMA 495 Polymeric Engineering Materials I (3 credits)
Prerequisite: ENMA300. Credit only granted for: ENCH490 or ENMA495.
Study of polymeric engineering materials and the relationship to structural type. Elasticity, viscoelasticity, anelasticity and plasticity of single and multiphase materials. Emphasis is on polymetric materials.

ENMA 499 Senior Laboratory Project (1-3 credits)
Restriction: Senior standing.
Students work with a faculty member on an individual laboratory project in one or more of the areas of engineering materials. Students will design and carry out experiments, interpret data and prepare a comprehensive laboratory report.

ENMA 620 Polymer Physics (3 credits)
Prerequisite: ENMA471; or permission of instructor.
The thermodynamics, structure, morphology and properties of polymers. Developing an understanding of the relationships between theory and observed behavior in polymeric materials.

ENMA 621 Advanced Design Composite Materials (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA621 or ENMA698A. Formerly: ENMA698A.
Fundamentals of design, processing, and selection of composite materials for structural applications are covered. The topics include a review of all classes of engineering materials, an in-depth analysis of micro and macro mechanical behavior including interactions at the two-phase interfaces, modeling of composite morphologies for optimal microstructures, material aspects, cost considerations, processing methods- including consideration of chemical reactions, stability of the interfaces and material selection.

ENMA 624 Radiation Engineering (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA624 or ENMA698E. Formerly: ENMA698E.
Ionizing radiation, radiation dosimetry and sensors, radiation processing, radiation effects on ; polymers, metals, semiconductors, liquid, and gas, radiation in advance manufacturing, radiation-physical technology.

ENMA 625 Biomaterials (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA425, ENMA698I, BIOE698I, or ENBE453. Formerly: ENMA698I.
Examination of materials used in humans and other biological systems in terms of the relationships between structure, fundamental properties and functional behavior. Replacement materials such as implants, assistive devices such as insulin pumps and pacemakers, drug delivery systems, biosensors, engineered materials such as artificial skin and bone growth scaffolds, and biocompatibility will be covered.

ENMA 626 Fundamentals of Failure Mechanisms (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Also offered as: ENRE600. Credit only granted for: ENMA626, ENMA698M, ENMA698R, or ENRE600. Formerly: ENMA698M and ENMA698R.
Advanced failure mechanisms in reliability engineering wiil be taught from a basic materials and defects point of view. The methods of predicting the physics of failure of devices, materials, components and systems are reviewed. The main emphasis will be given to basic degradation mechanisms through understanding the physics, chemistry, and mechanics of such mechanisms. Mechanical failures are introduced through understanding fatigue, creep and yielding in materials, devices and components. The principles of cumulative damage and mechanical yielding theory are taught. The concepts of reliability growth, accelerated life testing, environmental testing are introduced. Physical, chemical and thermal related failures are introduced through a basic understanding of degradation mechanisms such as diffusion, electromigration, defects and defect migration. The failure mechanisms in basic material types will be taught. Failure mechanisms observed in real electronic devices and electronic packaging will also be presented. Problems related to manufacturing, and microelectronics will

be analyzed. Mechanical failures are emphasized from the point of view of complex fatigue theory.

ENMA 627 Nanotechnology Characterization (3 credits)
Credit only granted for: ENMA627 or ENME698T. Formerly: ENMA698T.
Techniques to characterize the properties of materials whose characteristic dimensions are a few to a few hundred nanometers, including "conventional" nanocrystalline materials, but concentrating on "novel" nanomaterials: carbon nanotubes, quantum dots, quantum wires, and quantum wells will be covered. The emphasis is on recent results from the scientific literature concerning those properties that make nanostructures interesting: quantum effects, novel transport phenomena, enhanced mechanical properties associated with localization and with small crystalline size.

ENMA 630 Advanced Nanosized Materials: Synthesis and Utilization (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA630 or ENMA6998G. Formerly: ENMA698G.
This course covers fundamental theory and fabrication-related aspects of nanoscale materials science. Topics: Quantization of energy level in solids and its effect on properties. Nucleation, growth and aging. Nano-epitaxy. Anisotropic crystal engineering. Electrical Transport. Nano-magnetism. Properties of carbon nanotubes. Applications in electronics, optics, data storage, energy and biomedicine.

ENMA 631 Advanced Nanomechanics of Biomaterials (3 credits)
Prerequisite: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA631 or ENMA698B. Formerly: ENMA698B.
Students will develop understanding of the latest scientific developments and discoveries in the nanoscale structure and properties of biological materials. Topics include nanostructures of biomaterials, physiological roles under mechanical forces, biopolymers, protein folding, and self-assembly. Also included are characterization methods of nanomechanical properties using single molecule techniques. Current applications of nanobiomaterials in the area of molecular machines, molecular self-assembly, and nanoscaffold are discussed.

ENMA 640 Advanced Nano Processing of Materials with Plasma (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA440, ENMA489P, ENMA698P, or ENMA640. Formerly: ENMA698P.
Plasmas are used to control the micro-and Nanoscale level structure of materials including patterning at the micro-and nanoscale level using plasma etching techniques. The course establishes the scientific understanding required for the efficient production of nano-structure using plasma techniques.

ENMA 641 Nanotechnology Characterization (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA698T or ENMA641. Formerly: ENMA698T.
Techniques to characterize the properties of materials whose characteristic dimensions are a few to a few hundred nanometers, including conventional nanocrystalline materials, but concentrating on novel nanomaterials: carbon nanotubes, quantum dots, quantum wires, and quantum wells are covered. The emphasis is on recent results from the scientific literature concerning those properties that make nanostructures interesting: quantum effects, novel transport phenomena, enhanced mechanical properties associated with localization and with small crystallite size.

ENMA 642 Current Trends in Nanomaterials (3 credits)
Credit only granted for: ENMA642 or ENMA698N. Formerly: ENMA698N.
Presents a historical and contemporary perspective of the trends of development of nanomaterials. Having characteristic dimensions in the range of 1-100 nanometers, these materials are difficult to synthesize a nd characterize but are nevertheless at the forefront of science and tec hnology in many fields. Through detailed analysis of the current literat ure, all students will develop a sense for not only where the science an d technology has come but also where it is going.

ENMA 643 Advanced Photonic Materials (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA698Z, ENRE648Z, or ENMA643. Formerly: ENMA698Z.
The understanding of the basic optical processes in photonic devices and systems compsed of waveguides, light emitting diodes and lasers, as well as modulators is developed. Lectures on basic degradation mechanisms of such systems will be presented. The area of organic based LED reliability will be covered from the point of view of the stability of the organic-inorganic interface.

ENMA 644 Advanced Ceramics (3 credits)
Credit only granted for: ENMA644 or ENMA698C. Formerly: ENMA698C.
Introduces concepts such as crystal chemistry, defect chemistry and ternary phase equilibria which can also be used to illustrate the various types of advanced ceramics (superconductors; superionic conductors; dielectrics including ferroelectrics; optical materials; high temperature structural materials; etc.) and allow an understanding of their behaviors.

ENMA 645 Advanced Liquid Crystals and Other Monomeric Soft Matter Materials (3 credits)
Credit only granted for: ENMA645 or ENMA698D. Formerly: ENMA698D.
Elective course on the properties and behavior of liquid crystal and related soft materials, and their relationship to biomaterials and applications.

ENMA 650 Nanometer Structure of Materials (3 credits)
Prerequisite: ENMA460; or students who have taken courses with comparable content may contact the department. And permission of ENGR-Materials Science & Engineering department.
The basic concepts required for understanding nanostructured materials and their behavior will be covered. Topics covered include the structural aspects of crystalline and amorphous solids and relationships to bonding types, point and space groups. Summary of diffraction theory and practice. The reciprocal lattice. Relationships of the microscopically measured properties to crystal symmetry. Structural aspects of defects in crystalline solids.

ENMA 659 Special Topics in Electronic Materials (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits if content differs.
Topics of current interest in the design and manufacture of electronic materials.

ENMA 660 Thermodynamics in Materials Science (3 credits)
Corequisite: ENMA650. Restriction: Permission of ENGR-Materials Science & Engineering department.
Thermodynamics of engineering solids. Thermal, diffusional and mechanical interactions in macroscopic systems. Systems in thermal contact, systems in thermal and diffusive contact, systems in thermal and mechanical contact.

ENMA 661 Kinetics of Reactions in Materials (3 credits)
Prerequisite: ENMA660.
The theory of thermally activated processes in solids as applied to diffusion, nucleation and interface motion. Cooperative and diffusionless transformations. Applications selected

from processes such as allotropic transformations, precipitation, martensite formation, solidification, ordering, and corrosion.

ENMA 662 Advanced Smart Materials (3 credits)

Credit only granted for: ENMA662 or ENMA698W. Formerly: ENMA698W.

This course will cover the three ferroic materials, ferromagnetic, ferroelectric, and ferroelastic (also known as Shape Memory Alloy, SMA) as well as materials that are simultaneously ferromagnetic and ferroelectric etc. Their similarities and differences will be identified and their atomic level and crystal structure examined. Phase transformations are very important and will be treated in some detail. Applications, e.g. permanent magnets, electronic magnetic materials, digital storage elements, actuators and sensors as well as SMAs for vision glasses, self-adjusting valves and the like will be covered.

ENMA 669 Special Topics in the Chemical Physics of Materials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department; and permission of instructor.

ENMA 671 Defects in Materials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department.

Fundamental aspects of point (electronic and atomic) defects, dislocations, and surfaces and interfaces in materials. Defect interactions, defect models, and effects of zero, one and two dimensional defects on material behavior.

ENMA 674 Advanced Computational Materials Science (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA674 or ENMA 698A. Formerly: ENMA698A.

An introduction for beginning graduate students to study atomistic modeling and simulation techniques that are used in materials science. Theories and applications of atomistic scale modeling techniques to simulate, understand, and predict the properties of materials will be covered. Topics include: molecular statics, quantum mechanical methods, molecular dynamics simulations and Monte Carlo simulations.

ENMA 679 Special Topics in the Mechanical Behavior of Materials (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department.

Topics of current interest in the mechanical behavior of materials.

ENMA 680 Determination of Structure, Chemical Composition and Defects in Materials (3 credits)

Prerequisite: ENMA650.

Basic principles of electron microscopy theory, electron diffraction, and imaging theory. The electron beam sample interaction that gives rise to different signals is related to the structural and compositional information that is obtained from a sample using a TEM. The most common TEM techniques for structural characterization of a sample, namely, electron diffraction, bright/dark field imaging, and high resolution lattice imaging are discussed. Compositional information obtained from x-ray fluorescence and electron energy loss as well as the resolution of these techniques is also covered. A description of techniques used to study magnetic materials is also presented.

ENMA 681 Diffraction Techniques in Materials Science (3 credits)

Prerequisite: Permission of ENGR-Materials Science & Engineering department.

Advanced methods of x-ray scattering/diffraction available thanks to the more powerful sources available to us. The availability of these sources enables us to study liquid crystals, polymers, nanomaterials, quasiorganized materials (including nano) and disordered materials. We will consider scattering/diffraction from the electronic level and build up to the molecular level.

ENMA 682 Electron Microscopy for Research (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA682 or ENMA698J. Formerly: ENMA698J.

An overview of the basic principles of operation for modern electron microscopes and how they are used in modern research. Details will be given on the construction of microscopes, their basic operation, and the types of questions that can be addressed with an electron microscope. Emphasis will be placed on a conceptual understanding of the underlying theories, and how to apply these to real-world research problems. Independent study into a specific area of electron microscopy will contribute to a term paper. Upon completion of this course, student will be expected to have a basic understanding sufficient to give interpretations of microscopy images and to suggest the correct tool or approach for certain research studies.

ENMA 683 Structural Determination Laboratory (1 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA698L or ENMA683. Formerly: ENMA698L.

The operation of an electron microscope is covered. TEM techniques that are used to characterize the structure, defects and composition of a sample are presented and used to study a variety of materials. These techniques are: electron diffraction patterns, bright/dark field imaging, high resolution lattic imaging and energy dispersive x-ray spectroscopy. Also covers different sample preparation techniques for TEM. The goal is that the students become independent users of the TEM.

ENMA 684 Advanced Finite Element Modeling (3 credits)

Restriction: Permission of ENGR-Materials Science & Engineering department. Credit only granted for: ENMA684 or ENMA698I. Formerly: ENMA698I.

A brief review of mechanical behavior of materials, introduction to Finite Element Modeling (FEM), and procedures for predicting mechanical behavior of materials by FEM using computer software (at present ANSYS). The FEM procedures include, setting up the model, mesh generation, data input and interpretation of the results.

ENMA 685 Advanced Electrical and Optical Materials (3 credits)

Credit only granted for: ENMA685 or ENMA698F. Formerly: ENMA698F.

Students become familiar with basic and state of the art knowledge of some technologically relevent topics in materials engineering and applied physics, including dielectric/ferroelectric materials, magnetic materials, superconductors, multiferroic materials and optical materials with an underlying emphasis on the thin film and device fabrication technology. Fundamental physical properties and descriptions of different materials and their applications are included. Discussion will include new developments in the fields.

ENMA 687 Nanoscale Photonics and Applications (3 credits)

Credit only granted for: ENMA687 or ENMA698Z. Formerly: ENMA698Z.

Advanced topics in photonics including optical ray propogation, LEDS and the interaction of light in nanostructured materials for optoelectronic applications will be covered.

ENMA 688 Seminar in Materials Science and Engineering (1 credits)

Restriction: Must be in Engineering: Materials Science program. Repeatable to 4 credits if content differs. Formerly: ENMA697.

Current research in materials science and engineering and related fields.

ENMA 689 Special Topics in Engineering Materials (3 credits)
Restriction: Permission of instructor; and permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits if content differs. Formerly: ENMA691.

ENMA 698 Special Problems in Materials Science and Engineering (1-3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits if content differs.
Individual, supervised study in materials science and engineering.

ENMA 797 Independent Study (3 credits)
This course is designed to provide students with a directed independent study course in order to prepare the scholarly paper required for the master's degree without thesis degree option.

ENMA 799 Master's Thesis Research (1-6 credits)

ENMA 808 Advanced Topics in Engineering Materials (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits if content differs.

ENMA 898 Pre-Candidacy Research (1-8 credits)

ENMA 899 Doctoral Dissertation Research (1-8 credits)

Engineering, Mechanical (ENME)

ENME 400 Machine Design (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in ENME361. Restriction: Permission of ENGR-Mechanical Engineering department.
Design of mechanical elements and planar machines. Failure theories. Design of pressure vessels, joints, rotating elements, and transmission elements. Kinematic structures, graphical, analytical, and numerical analysis and synthesis of linkages, gear trains, and flywheels are covered.

ENME 408 Selected Topics in Engineering Design (3 credits)
Restriction: Must be in Engineering: Mechanical program; and senior standing. Or permission of ENGR-Mechanical Engineering department. Repeatable to 6 credits if content differs.
Creativity and innovation in design. Generalized performance analysis, reliability and optimization as applied to the design of components and engineering systems. Use of computers in design of multivariable systems.

ENME 410 Design Optimization (3 credits)
Prerequisite: ENME271; or MATH206. Restriction: Permission of ENGR-Mechanical Engineering department; and junior or senior standing.
Introduction to the formal process of design optimization, including analytical and computational methods. Step by step design optimization techniques. Design optimization concepts, necessary and sufficient optimality conditions and solution techniques. Solution evaluation and tradeoff exploration.

ENME 414 Computer-Aided Design (3 credits)
Prerequisite: MATH241; or students who have taken courses with comparable content may contact the department. Credit only granted for: ENME 414 or ENME272.
Introduction to computer graphics. Plotting and drawing with computer software. Principles of writing interactive software. The applications of computer graphics in computer-aided design. Computer-aided design project.

ENME 421 Engineering Design Ideation (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in ENME371. Restriction: Junior standing or higher. Additional information: Ideally, this course should be taken prior to capstone design.
Engineering Design Methods is a technical elective for engineering students who wish to improve their ability to produce design ideas (i.e., the ideation process) for further development into conceptual ideas. Ideation is the creative, idea generation activity that happens at the beginning of the conceptual design process. Ideation methods are often built around creativity improving strategies and are often designed for individual use prior to presenting the results in a team setting.

ENME 423 Modern Climate Control and Building Energy Design/Analysis (3 credits)
Prerequisite: ENES232. Corequisite: ENME332. Restriction: Permission of ENGR-Mechanical Engineering department.
Fundamentals and design calculations of heat and moisture transfer in buildings; evaluation of cooling, heating and power requirements of buildings; building energy consumption simulations, use of alternative energy and energy conservation measures in buildings; fundamentals of fans/pumps and air/water distribution in buildings; introduction to refrigeration and energy systems for data centers and other mission-critical facilities.

ENME 424 Urban Microclimate and Energy (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in ENME332. Recommended: ENME423. Restriction: Permission of ENGR-Mechanical Engineering department. Credit only granted for: ENME424 or ENME808I.
Urban microclimate from the perspective of transient heat and mass transfer using building energy simulations for building clusters as well as LEED building certification criteria. The focus is on understanding building energy consumption and environmental impacts from the individual building scale to a neighborhood scale.

ENME 426 Production Management (3 credits)
Credit only granted for: BMGT385 or ENME426.
The basic concepts and models needed to understand and design manufacturing systems, including the history of manufacturing, performance measures, queuing systems, variability, production planning and scheduling, lean manufacturing, and pull production control.

ENME 430 Fundamentals of Nuclear Reactor Engineering (3 credits)
Prerequisite: MATH246. Restriction: Permission of ENGR-Mechanical Engineering department.
Fundamental aspects of nuclear physics and nuclear engineering, including nuclear interactions; various types of radiation and their effects on materials and humans; and basic reactor physics topics, including simplified theory of reactor critically.

ENME 431 Nuclear Reactor Systems and Safety (3 credits)
Prerequisite: ENME430 and MATH246. Restriction: Permission of ENGR-Mechanical Engineering department. Also offered as: ENNU465. Credit only granted for: ENNU465 and ENME431.
Engineering, material and thermal aspects of light water reactors, fast reactors, high temperature gas reactors, heavy water moderated reactors, breeder reactors, advanced reactors including GEN IV designs. Evolution of light water reactor safety and regulation in the US that has culminated in the current body of regulations.

ENME 432 Reactor and Radiation Measurements Laboratory (3 credits)
Prerequisite: ENME430 and MATH246. Restriction: Permission of ENGR-Mechanical Engineering department. Also offered as: ENNU440. Credit only granted for: ENNU440 or ENME432.
Basics concepts of nuclear radiation and radiation detectors including types of radiation, radioactive decay, and interactions of radiation with matter.

ENME 436 Renewable Energy (3 credits)
Prerequisite: ENME331. Restriction: Must be in a major within the ENGR-Mechanical Engineering department. Credit only granted for: ENME489K or ENME436. Formerly: ENME489K.
Fundamentals, design/analysis tools, and state of the art renewable energy technologies. Energy resources and global perspectives of current and future energy demand/consumption trends, followed by prime renewable energy technologies, including wind, solar, hydro, geothermal, and ocean thermal energy conversion. Economics of renewable energy, energy conservation opportunities, CO2 capture and storage, and thermal energy storage.

ENME 442 Information Security (3 credits)
Restriction: Must have Senior standing in engineering; and permission of ENGR-Mechanical Engineering department. Also offered as: ENRE684. Credit only granted for: ENRE648J, ENME442, ENRE684, or ENPM808E.
The materials presented are divided into three major components: overview, detailed concepts and implementation techniques. The topics to be covered are: general security concerns and concepts from both a technical and management point of view, principles of security, architectures, access control and multi-level security, trojan horses, covert channels, trap doors, hardware security mechanism, security models, security kernels, formal specifications and verification, networks and distribution systems and risk analysis.

ENME 454 Vehicle Dynamics (3 credits)
Corequisite: ENME361. Restriction: Permission of ENGR-Mechanical Engineering department.
The fundamentals of passenger vehicle and light truck design and vehicle dynamics are covered. The engineering principles associated with acceleration, braking, handling, ride quality, aerodynamics, and tire mechanics are discussed, as well as suspension and steering design.

ENME 461 Control Systems Laboratory (3 credits)
Prerequisite: ENME351 and ENME361. Restriction: Permission of ENGR-Mechanical Engineering department. Credit only granted for: ENEE461 or ENME461.
Students will design, implement, and test controllers for a variety of systems. This will enhance their understanding of feedback control familiarize them with the characteristics and limitations of real control devices. Students will also complete a small project. This will entail writing a proposal, purchasing parts for their controller, building the system, testing it, and writing a final report describing what they have done.

ENME 462 Vibrations, Controls, and Optimization II (3 credits)
Prerequisite: ENME351 and ENME361.
Continuation of ENME 361. Fundamentals of vibration, controls, and optimization. Analysis and design in time, Laplace and frequency domains. Mathematical descriptions of system response, system stability, control and optimization. Optimal design of mechanical systems.

ENME 464 Cost Analysis for Engineers (3 credits)
Prerequisite: ENME392; or students who have taken courses with comparable content may contact the department. Restriction: Permission of ENGR-Mechanical Engineering department.
An introduction to the financial and cost analysis aspects of product engineering. Introduces key elements of traditional engineering economics including interest, present worth, depreciation, taxes, inflation, financial statement analysis, and return on investment. Provides an introduction to cost modeling as it applies to product manufacturing and support. Cost modeling topics will include: manufacturing cost analysis, life-cycle cost modeling (reliability and warranty), and cost of ownership.

ENME 466 Lean Six Sigma (3 credits)
Prerequisite: ENME392, BMGT230, or STAT400; or students who have taken courses with comparable content may contact the department.
This course intends to provide in-depth understanding of Lean Six Sigma and its Define - Mearsure - Analyze - Improve - Control (DMAIC) Breakthrough Improvement Strategy. The emphasis is placed on the DMAIC process which is reinforced via application of semester long corporate projects and case study analysis.

ENME 470 Finite Element Analysis (3 credits)
Restriction: Senior standing; and permission of ENGR-Mechanical Engineering department.
Basic concepts of the theory of the finite element method. Applications in solid mechanics and heat transfer.

ENME 472 Integrated Product and Process Development (3 credits)
Prerequisite: ENME371.
Integration of product development with the development process. Design strategies. Product architecture. Design for manufacturing. Selection of materials. Design for assembly.

ENME 473 Mechanical Design of Electronic Systems (3 credits)
Design considerations in the packaging of electronic systems. Production of circuit boards and design of electronic assemblies. Vibration, shock, fatigue and thermal considerations.

ENME 474 Design in Electronic Product Development (3 credits)
Prerequisite: ENME473.
Merges technology, analysis, and design concepts into a single focused activity that results in the completed design of an electronic product. A set of product requirements are obtained from an industry partner, the students create a specification for the product, iterate the specification with the industry partner, then design and analyze the product. Students will get hands-on experience using real design implementation tools for requirements capture, tradeoff analysis, scheduling, physical design and verification. Issues associated with transferring of the design to manufacturing and selection of manufacturing facilities will also be addressed.

ENME 476 Microelectromechanical Systems (MEMS) I (3 credits)
Restriction: Senior standing. Credit only granted for: ENME476 or ENME489F. Formerly: ENME489F.
Fundamentals of microelectromechanical systems (MEMS). Introduction to transducers and markets. MEMS fabrication processes and materials, including bulk micromachining, wet etching, dry etching, surface micromachining, sacrificial layers, film deposition, bonding, and non-traditional micromachining. Introduction to the relevant solid state physics, including crystal lattices, band structure, semiconductors, and doping. The laboratory covers safety, photolithography, profilometry, wet etching.

ENME 477 Microelectromechanical Systems (MEMS) II (3 credits)
Prerequisite: ENME476.
Fabrication of devices designed in MEMS I, including everything from mask printing through training on state-of-the-art fabrication equipment through device

testing. In-depth understanding of MEMS devices and technologies, such as mechanical and electromagnetic transducers, microfluidics, and chemical sensors.

ENME 481 Lab-on-a-Chip Microsystems (3 credits)

Restriction: Senior standing; and permission of ENGR-Mechanical Engineering department. Credit only granted for: ENME481, ENME808E, ENME740. Formerly: ENME489E.
Fundamentals and application of lab-on-a-chip and microfluidic technologies. A broad view of the field of microfluidics, knowledge of relevant fabrication methods and analysis techniques, and an understanding of the coupled multi-domain phenomena that dominate the physics in these systems.

ENME 488 Special Problems (3 credits)

Restriction: Permission of ENGR-Mechanical Engineering department.
Advanced problems in mechanical engineering with special emphasis on mathematical and experimental methods.

ENME 489 Special Topics in Mechanical Engineering (3 credits)

Restriction: Permission of ENGR-Mechanical Engineering department. Repeatable to 6 credits.
Selected topics of current importance in mechanical engineering.

ENME 600 Engineering Design Methods (3 credits)

An introductory graduate level course in critical thinking about formal methods for design in Mechanical Engineering. Course participants gain background on these methods and the creative potential each offers to designers. Participants will formulate, present, and discuss their own opinions on the value and appropriate use of design materials for mechanical engineering.

ENME 605 Advanced Systems Control (3 credits)

Prerequisite: ENME462; or permission of instructor.
Modern control theory for both continuous and discrete systems. State space representation is reviewed and the concepts of controllability and observability are discussed. Design methods of deterministic observers are presented and optimal control theory is formulated. Control techniques for modifying system characteristics are discussed.

ENME 607 Engineering Decision Making and Risk Management (3 credits)

Also offered as: ENRE671. Credit only granted for: ENME808X, ENRE671 or ENME607. Formerly: ENME 808X.
Individual decision-making, group decisionmaking, and organizations of decision-makers in the context of engineering design, project management, and other functions. Techniques for making better decisions, for understanding how decisions are related to each other, and for managing risk.

ENME 610 Engineering Optimization (3 credits)

Overview of applied single- and multi-objective optimization and decision making concepts and techniques with applications in engineering design and/or manufacturing problems. Topics include formulation examples, concepts, optimality conditions, unconstrained/constrained methods, and post-optimality sensitivity analysis. Students are expected to work on a semester-long real-world multi-objective engineering project.

ENME 611 Fiber Optics (3 credits)

Credit only granted for: ENME611,ENME808 or ENME489R. Formerly: ENME808R.
Introduces students to fiber optics, provides a background including fiber optic components and terminology, and equip students with ability to understand and evaluate various kinds of fiber optic sensors for a wide range of applications along with a detailed understanding of relevant signal processing and analysis techniques.

ENME 625 Multidisciplinary Optimization (3 credits)

Overview of single- and multi-level design optimization concepts and techniques with emphasis on multidisciplinary engineering design problems. Topics include single and multilevel optimality conditions, hierarchic and nonhierarchic modes and multilevel post optimality sensitivity analysis. Students are expected to work on a semester-long project.

ENME 631 Advanced Conduction and Radiation Heat Transfer (3 credits)

Prerequisite: ENME332; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Theory of conduction and radiation. Diffused and directional, poly- and mono-chromatic sources. Quantitative optics. Radiation in enclosures. Participating media. Integrodifferential equations. Multidimensional, transient and steady-state conduction. Phase change. Coordinate system transformations.

ENME 632 Advanced Convection Heat Transfer (3 credits)

Credit only granted for: ENNU615 or ENME632.
Statement of conservation of mass, momentum and energy. Laminar and turbulent heat transfer in ducts, separated flows, and natural convection. Heat and mass transfer in laminar boundary layers. Nucleate boiling, film boiling, Leidenfrost transition and critical heat flux. Interfacial phase change processes; evaporation, condensation, industrial applications such as cooling towers, condensers. Heat exchangers design.

ENME 633 Molecular Thermodynamics (3 credits)

Restriction: Permission of ENGR-Mechanical Engineering department.
An examination of the interactions between molecules, which govern thermodynamics relevant to engineering, will be conducted. We will investigate both classical and statistical approaches to thermodynamics for understanding topics such as phase change, wetting of surfaces, chemical reactions, adsorption, and electrochemical processes. Statistical approaches and molecular simulation tools will be studied to understand how molecular analysis can be translated to macroscopic phenomena.

ENME 635 Energy Systems Analysis (3 credits)

Rankine cycles with nonazeotropic working fluid mixtures, two-, multi- and variable-stage absorption cycles and vapor compression cycles with solution circuits. Power generation cycles with working fluid mixtures. Development of rules for finding all possible cycles suiting a given application or the selection of the best alternatives.

ENME 640 Fundamentals of Fluid Mechanics (3 credits)

Prerequisite: Must have completed partial differential equations at the level of MATH 462; or permission of ENGR-Mechanical Engineering department. Formerly: ENME651.
Equations governing the conservation of mass, momentum, vorticity and energy in fluid flows. Low Reynolds number flows. Boundary layers. The equations are illustrated by analyzing a number of simple flows. Emphasis is placed on physical understanding to facilitate the study of advanced topics in fluid mechanics.

ENME 641 Viscous Flow (3 credits)

Prerequisite: ENME640; or students who have taken courses with comparable content may contact the department; or permission of instructor. Formerly: ENME652.
Fluid flows where viscous effects play a significant role. Examples of steady and unsteady flows with exact solutions to the Navier-Stokes equations. Boundary layer theory. Stability of laminar flows and their transition to turbulence.

ENME 642 Hydrodynamics I (3 credits)
Prerequisite: ENME640; or students who have taken courses with comparable content may contact the department; or permission of instructor. Formerly: ENME653.
Exposition of classical and current methods used in analysis of inviscid, incompressible flows.

ENME 644 Fundamentals of Acoustics (3 credits)
This course will cover the fundamental principles of acoustics allowing the students to go on to more advanced course in acoustics, sauch as Underwater Sound Propagation, Active Noise Control, or Radiation and Scattering from Elastic Structures.

ENME 646 Computational Fluid Dynamics (3 credits)
Prerequisite: Must have completed graduate-level fluid mechanics; or permission of instructor.
Fundamentals of numerical analysis of engineers. Inversion of large, sparse matrices. Numerical solution of the incompressible Navier-Stokes equations in Cartesian and curvilinear grids. Application to turbulent flows and micro-fluidics.

ENME 647 Multiphase Flow and Heat Transfer (3 credits)
Boiling and condensation in stationary systems, phase change heat transfer phenomenology, analysis and correlations. Fundamentals of two-phase flow natural circulation in thermal hydraulic multi-loop systems with applications to nuclear reactors safety. Multiphase flow fundamentals. Critical flow rates. Convective boiling and condensation. Multiphase flow and heat transfer applications in power and process industries.

ENME 656 Physics of Turbulent Flow (3 credits)
Prerequisite: ENME640; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Definition of turbulence and its physical manifestations. Statistical methods and the transport equations for turbulence quantities. Laboratory measurement and computer simulation methods. Isotropic turbulence. Physics of turbulent shear flows.

ENME 657 Analysis of Turbulent Flow (3 credits)
Prerequisite: ENME640; and (ENME641; or students who have taken courses with comparable content may contact the department). Or permission of instructor.
Mathematical representation of turbulent transport, production and dissipation. Closure schemes for predicting flows. Recent advances in direct and large eddy numerical simulation techniques.

ENME 662 Linear Vibrations (3 credits)
Development of equations governing small oscillations and spatially continuous systems. Newton's equations, Hamilton's principle, and Lagrange's equations. Free and forced vibrations of mechanical systems. Modal analysis. Finite element discretization and reductions of continuous systems. Numerical methods. Random vibrations.

ENME 664 Dynamics (3 credits)
Prerequisite: ENES221; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Kinematics in plane and space; Dynamics of particle, system of particles, and rigid bodies. Holonomic and non-holonomic constraints. Newton's equations, D'Alembert's principle, Hamilton's principle, and equations of Lagrange. Impact and collisions. Stability of equilibria.

ENME 665 Advanced Topics in Vibrations (3 credits)
Prerequisite: ENME662; and permission of instructor.
Nonlinear oscillations and dynamics of mechanical and structural systems. Classical methods, geometrical, computational and analytical methods. Birfurcations of equillibrium and periodic solutions; chaos.

ENME 670 Continuum Mechanics (3 credits)
Mechanics of deformable bodies, finite deformation and strain measures, kinematics of continua and global and local balance laws. Thermodynamics of continua, first and second laws. Introduction to constitutive theory for elastic solids, viscous fluids and memory dependent materials. Examples of exact solutions for linear and hyper elastic solids and Stokesian fluids.

ENME 671 Deformable Bodies (3 credits)
Credit only granted for: ENME671, ENME808Y, or ENME489Y. Formerly: ENME808Y.
Covers advanced concepts in material behavior, including plasticity, fracture, fatigue, and time-dependent material behavior. Concepts will be developed mathematically and completely in 3-D using tensorial analysis.

ENME 672 Composite Materials (3 credits)
Micromechanics of advanced composites with passive and active reinforcements, mathematical models and engineering implications, effective properties and damage mechanics, recent advances in "adaptive" or "smart" composites.

ENME 673 Energy and Variational Methods in Applied Mechanics (3 credits)
Application of variational principles to mechanics. Includes virtual work, potential energy, strain energy, Castigliano's generalized complementary energy, and the principles of Hellinger-Reissner and Hamilton. Legendre transforms and the foundations of the calculus of variations. Singularities and stability in a potential energy function. Applications to rigid, linear and non-linear elastic, and nonconservative examples. Approximation techniques such as Ritz, Petrov-Galerkin, least-squares, etc. Presents the basis for the finite element method.

ENME 674 Finite Element Methods (3 credits)
Credit only granted for: ENME 674, ENAE652, ENPM652 or ENPM808F.
Theory and application of finite element methods for mechanical engineering problems such as stress analysis, thermal and fluid flow analysis, electro-magnetic field analysis and coupled boundary-value problems for "smart" or "adaptive" structure applications, stochastic finite element methods.

ENME 675 A Mathematical Introduction to Robotics (3 credits)
Credit only granted for: ENME675 or ENME808V. Formerly: ENME808V.
Designed to provide graduate students with some of the concepts in robotics from a mathematical viewpoint, including introduction to group theory and basics of SO(3) and SE(3) group applied to robotics; rigid body motion; manipulator kinematics; introduction to holonomic & non-holonomic constraints; dynamics of robot manipulators.

ENME 678 Fracture Mechanics (3 credits)
An advanced treatment of fracture mechanics covering in detail the analysis concepts for determining the stress intensity factors for various types of cracks. Advanced experimental methods for evaluation of materials or structures for fracture toughness. Analysis of moving cracks and the statistical analysis of fracture strength. Finally, illustrative fracture control plans are treated to show the engineering applications of fracture mechanics.

ENME 680 Experimental Mechanics (3 credits)
Advanced methods of measurement in solid and fluid mechanics. Scientific photography, moire, photoelasticity, strain gages, interferometry, holography,

speckle, ndt techniques, shock and vibration, and laser anemometry.

ENME 684 Modeling Material Behavior (3 credits)

Prerequisite: ENME670; or permission of instructor.

Constitutive equations for the response of solids to loads, heat, etc. based on the balance laws, frame invariance, and the application of thermodynamics to solids. Non-linear elasticity with heat conduction and dissipation. Linear and non-linear non-isothermal viscoelasticity with the elastic-viscoelastic correspondence principle. Classical plasticity and current viscoplasticity using internal state variables. Maxwell equal areas rule, phase change, and metastability and stability of equilibrium states. Boundary value problems. Introduction to current research areas.

ENME 690 Mechanical Fundamentals of Electronic Systems (3 credits)

An understanding of the fundamental mechanical principles used in design of electronic devices and their integration into electronic systems will be provided. Focus will be placed on the effect of materials compatibility, thermal stress, mechanical stress, and environmental exposure on product performance, durability and cost. Both electronic devices and package assemblies will be considered. Analysis of package assemblies to understand thermal and mechanical stress effects will be emphasized through student projects.

ENME 695 Design for Reliability (3 credits)

Reliability is the ability of a product or system to perform as intended (i.e., without failure and within specified performance limits) for a specified time, in its life-cycle conditions. Knowledge of reliability concepts and principles, as well as risk assessment, mitigation and management strategies prepares engineers to contribute effectively to product development and life cycle management. This course teaches the fundamental knowledge and skills in reliability as it pertains to the design, manufacture, and use of electrical, mechanical, and electro-mechanical products. Topics cover the suitability of the supply chain members to contribute towards development, manufacturing, distribution and support of reliable products; efficient and cost-effective design and manufacture of reliable products; process capability and process control; derating, uprating, FMMEA, reliability prediction and reliability allocation; how to plan and implement product testing to assess reliability; how to analyze degradation, failure, and return data to estimate fundamental reliability parameters; root cause analysis; and reliability issues associated with warranties, regulatory requirements, and liabilities.

ENME 700 Advanced Mechanical Engineering Analysis I (3 credits)

An advanced, unified approach to the solution of mechanical engineering problems, emphasis is on the formulation and solution of equilibrium, eigenvalue and propagation problems. Review and extension of undergraduate material in applied mathematics with emphasis on problems in heat transfer, vibrations, fluid flow and stress analysis which may be formulated and solved by classical procedures.

ENME 701 Sustainable Energy Conversion and the Environment (3 credits)

Recommended: ENME633. Credit only granted for: ENME701, ENME706 or ENME808D. Formerly: ENME706 and ENME808D.

Discussion of the major sources and end-uses of energy in our society with particular emphasis on renewable energy production and utilization. Introduces a range innovative technologies and discusses them in the context of the current energy infrastructure. Renewable sources such as wind and solar are discussed in detail. Particular attention is paid to the environmental impact of the various forms of energy.

ENME 704 Active Vibration Control (3 credits)

Prerequisite: ENME662 and ENME602; or students who have taken courses with comparable content may contact the department. Recommended: Completion of coursework or background in Vibrations and Control recommended. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

This course aims at introducing the basic principles of the finite element method and applying it to plain beams and beams treated with piezoelectric actuators & sensors. The basic concepts of structural parameter i dentification are presented with emphasis on Eigensystem Realization Algorithms (ERA) and Auto-regression models (AR). Different active control algorithms are then applied to beams/piezo-actuator systems. Among thes e algorithms are: direct velocity feedback, impedancematchingcontrol, modal control methods & sliding mode controllers. Particular focus is given to feedforward Leat Mean Square (LMS) algorithm & filtered-X LMS. O ptimal placement strategies of sensor & actuators are then introduced & applied to beam/piezo-actuator systems.

ENME 707 Combustion and Reacting Flow (3 credits)

Prerequisite: ENME331 and ENME332; or students who have taken courses with comparable content may contact the department.

This course covers thermochemistry and chemical kinetics of reacting flows in depth. In particular, we focus on the combustion of hydrocarbonf uels in both a phenomenological and mechanistic approach. The course co vers the specifics of premixed and nonpremixed flame systems, as wellasignition and extinction. Combustion modeling with equilibrium and chemical kinetic methods will be addressed. Environmental impact and emissi ons minimization will be covered in detail. Finally, the course will co ver available combustion diagnostic methods and their application in laboratory and real-world systems.

ENME 710 Applied Finite Elements (3 credits)

Prerequisite: ENME331 and ENME332. Restriction: Must be in one of the following programs (Engineering: Mechanical; Engineering: Aerospace; Engineering: Civil).

Application of finite element methods to the solution of engineering problems - such as stress analysis, thermal conductivity, fluid flow anlaysis, electro-magnetic field analysis and coupled boundary value problems. Emphasis is on the application of the techniques to the solution of pr oblems. Basic theory is covered at beginning of course.

ENME 711 Vibration Damping (3 credits)

Prerequisite: ENME662; or students who have taken courses with comparable content may contact the department. Recommended: Completion of coursework or background in Vibrations recommended. Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

This course aims at introducing the different damping models that describe the behavior of viscoelastic materials. Emphasis will be placedon m odeling the dynamics of simple structures (beams, plates & shells) with Passive Constrained Layer Damping (PCLD). Considerations will also be g iven to other types of surface treatments such as Magnetic Constrained Layer Damping (MCLD), Shunted Network Constrained Layer Damping (SNCLD),Active Constrained Layer Damping (ACLD) and Electrorheological Constrained Layer Damping (ECLD). Energy dissipation characteristics of the damp ing treatments will be presented analytically & by using the modal strain energy approach as applied to finite element models of vibrating structures.

ENME 712 Measurement, Instrumentation and Data Analysis for Thermo-Fluid Processes (3 credits)

This course is designed to offer systemic coverage of the methodologies for measurement and data analysis of thermal and fluid processes at the graduate level. The course materials will cover three broad categories: (1) Fundamentals of thermal and fluid processes in single phase and multi phase

flows as relates to this course; Measurement and Instrumentation techniques for measurement of basic quantities such as pressure, temperature, flow rate, heat flux, etc., and (3) Experimental Design and Planning, sources of errors in measurements, and uncertainty analysis.

ENME 713 Nanoparticle Aerosol Dynamics (3 credits)

Restriction: Permission of instructor. Also offered as: CHEM608. Credit only granted for: ENME713 or ENME808M. Formerly: ENME808M.

Covers the basic science of nanoparticle formation, growth, and transport; the science and engineering of measurement; and the environmental impact and industrial use of nanoparticles.

ENME 715 Design in Electronic Product Development (3 credits)

Recommended: ENME473 or ENME690; and knowledge of mathematical program language. Credit only granted for: ENME715 or ENME808Z. Formerly: ENME808Z.

Introduces students to the design methodologies and design tools used to create electronic systems; merges technology, analysis, and design concepts into a methodology for designing an electronic product.

ENME 722 Equilibrium Modeling in Engineering (3 credits)

Also offered as: ENCE722. Credit only granted for: ENCE722 or ENME722.

Provide motivation and introduction to equilibrium models involving economics and engineering. We will concentrate on models involving markets (Nash-Cournot, etc.), those wherein the activities are spatially diverse, those involving energy activities or traffic flow, as well as selected other examples in mechanical engineering. Areas that will be covered include:Review of relevant optimization theory, presentation of the mixed complementarity problem (MCP) and variational inequality problem (VIP) formats to solve equilibrium problems as well as introduction to existence and uniqueness results, review of relevant game theory notions, presentation of specific models for engineering-economic applications, presentations for algorithms to solve these equilibrium problems.

ENME 725 Probabilistic Optimization (3 credits)

Also offered as: ENCE725. Credit only granted for: ENME725 or ENCE725.

Provide an introduction to optimization under uncertainty. Chance-constrained programming, reliability programming, value of information, two stage problems with recourse, decomposition methods, nonlinear and linear programming theory, probability theory. The objectives of this course are to provide understanding for studying problems that involve optimization under uncertainty, learn about various stochastic programming formulations (chance constrained programs, two stage methods with recourse, etc.) relevant to engineering and economic settings, present theory for solutions to such problems, and present algorithms to solve these problems.

ENME 737 Prognostics and Health Management (3 credits)

Credit only granted for: ENME737 or ENME808A. Formerly: ENME808A.

Prognostics and health management (PHM) is an enabling discipline consisting of technologies and

ENME 740 Lab-on-a-Chip Microsystems (3 credits)

Credit only granted for: ENME 481, ENME 808E, ENME 740. Formerly: ENME 808E.

Fundamentals and application of lab-on-a-chip and microfluidic technologies. A broad view of the field of microfluidics, knowledge of relevant fabrication methods and analysis techniques, and an understanding of the coupled multi-domain phenomena that dominate the physics in these systems.

ENME 741 Management Science Applications in Engineering (3 credits)

Prerequisite: (ENCE302; or (ENME271 and ENME392)); and (MATH140 and MATH240). Or permission of instructor. Also offered as: ENCE603. Credit only granted for: ENME738, ENME741, or ENCE603. Formerly: ENME738.

The fundamentals of Management Science techniques in Project Management including: linear and integer programming, goal programming, multi-objective optimization, simulation, Analytic Hierarchy Process (AHP), deterministic and stochastic dynamic programming will be covered. Applications will be drawn from the Critical Path Method (CPM), resource management, and other areas of Project management.

ENME 742 Urban Microclimate and Energy (3 credits)

Also offered as: ENME424. Credit only granted for: ENME808I, ENME424 or ENME742. Formerly: ENME808I.

Examines urban microclimate from the perspective of transient heat and mass transfer using building energy simulations for building clusters. The focus is on understandingbuilding energy consumption and environmental impacts from the individual building scale (~100) to a neighborhood scale (~103). Emerging morphological properties of building clustersmodulate transient convective and radiative heat transfer resulting in different localmicroclimatic conditions. At the neighborhood scale, these conditions are analyzed using heatand mass transfer simulations in building clusters to provide boundary conditions for transient building energy simulations. At the individual building scale, besides the energy consumption,this course examines connection between indoor and outdoor environments.

ENME 765 Thermal Issues in Electronic Systems (3 credits)

Prerequisite: ENME331 and ENME332. Corequisite: ENME473; or students who have taken courses with comparable content may contact the department.

This course addresses a range of thermal issues associated with electronic products life cycle. Computational modeling approaches for various levels of system hierarchy. Advanced thermal management concepts including: single phase and phase change liquid immersion, heat pipes, and thermoelectrics.

ENME 770 Life Cycle Cost and System Sustainment Analysis (3 credits)

This course melds elements of traditional engineering economics with manufacturing process and sustainment modeling, and life cycle cost management concepts to form a practical foundation for predicting the cost of products and systems. Various manufacturing cost analysis methods will be presented including: process-flow, parametric, cost of ownership, and activity based costing. The effects of learning curves, data uncertainty, test and rework processes, and defects will be considered. Aspects of system sustainment including the impact on the life cycle (and life cycle costs) of reliability, maintenance, environmental impact, and obsolscence will be treated.

ENME 775 Manufacturing Technologies for Electronic Systems (3 credits)

Prerequisite: ENME690.

This highly multi-disciplinary course presents the mechanical fundamentals of manufacturing processes used in electronics assemblies. The emphasis is on quantitative modeling of the intrinsic impact that processing has on structure, properties, performance and durability. Students will learn how to quantitatively model many of the key manufacturing steps from mechanistic first principles, so that sensitivity studies and process optimization can be performed in a precise manner. Processes considered include: wafer-level processes such as polishing, lithography, etching and dicing; packaging operations such as die attachment, wirebonding, flip chip bonding, and plastic encapsulation; multilevel high-density substrate fabrication processes; assembly processes such as reflow and wave soldering of surface-mount components to electronic substrates.

ENME 780 Mechanical Design of High Temperature and High Power Electronics (3 credits)

Prerequisite: ENME382, ENME473, or ENME690.

This course will discuss issues related to silicon power device selection (IGBT, MCT, GTO, etc.), the characteristics of silicon device operation at temperatures greater thatn 125C, and the advantages of devices based on SOI and SiC. It will also discuss passive components and packaging materials selection for distributing and controlling power, focusing on the critical limitations to use of many passive components and packaging materials at elevated temperatures. In addition it will cover packaging techniques and analysis to minimize the temperature elevation caused by power dissipation. Finally, models for failure mechanisms in high temperature and high power electronics will be presented together with a discussion of design options to mitigate their occurrence.

ENME 788 Seminar (1-3 credits)
First or second semester. Credit in accordance with work outlined by mechanical engineering staff.

ENME 799 Master's Thesis Research (1-6 credits)

ENME 808 Advanced Topics in Mechanical Engineering (2-3 credits)

ENME 898 Pre-Candidacy Research (1-8 credits)

ENME 899 Doctoral Dissertation Research (1-8 credits)

Engineering, Nuclear (ENNU)

ENNU 468 Research (2-3 credits)
Restriction: Permission of instructor; and permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits.
Investigation of a research project under the direction of one of the staff members. Comprehensive reports are required.

ENNU 489 Special Topics in Nuclear Engineering (3 credits)
Restriction: Permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits if content differs.
Selected topics of current importance in nuclear engineering.

ENNU 609 Seminar in Nuclear Engineering (1 credits)

ENNU 620 Mathematical Techniques for Engineering Analysis and Modeling (3 credits)
Also offered as: ENRE620.
Probability and probability distributions; statistics; ordinary differential equations; linear algebra and vectors; Laplace transform; Fourier analysis; boundary value problems; series solutions to differential equations; partial differential equations; numerical methods.

ENNU 633 Convective Transport Phenomena in Single- and Multi-Phase Systems (3 credits)
Single medium - single phase systems, two-phase systems; Two media - solid-fluid systems: continuous interface, large interfacial area, fluid-fluid systems; Three media - solid-solid-fluid systems, solid-liquid-gas systems.

ENNU 643 Radiation Processing in Advanced Manufacturing (3 credits)
Radiation processing facilities for industrial production - electron beam, gamma, x-ray; types of electron beam machines; radiation processing - yields, G-values, throughput, efficiency; readiation in advanced manufacturing; radiation sensors and dosimetry; sterilization of industrial products; radiation-physical technology.

ENNU 648 Special Problems in Nuclear Engineering (1-16 credits)

ENNU 649 Selected Topics in Nuclear Engineering (1-3 credits)
Prerequisite: Permission of ENGR-Materials Science & Engineering department. Repeatable to 6 credits if content differs.
Topics of current interest in nuclear engineering.

ENNU 652 Principles of Reliability Analysis (3 credits)
Prerequisite: ENNU651. Also offered as: ENRE602.
Principal methods of reliability analysis, including fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis; methods of modeling systems for reliability analysis. Focus on problems related to process industries, fossil-fueled power plant availability, and other systems of concern to engineers.

ENNU 653 Mechanical reliability of Materials (3 credits)
Prerequisite: ENNU651.
Introduction to engineering materials; atomic structure; diffusion; defects; phase equilibria; kinetics and microstructures; deformations; fracture; materials testing; fatigue and creep; thermal properties; failure mechanisms; fractography; failure modeling.

ENNU 655 Radiation Engineering (3 credits)
Restriction: Permission of instructor; and permission of ENGR-Materials Science & Engineering department.
An analysis of such radiation applications as synthesizing chemicals, preserving foods, control of industrial processes, design of irradiation installations. E.G., Cobalt 60 gamma ray sources, electronuclear machine arrangement, and chemonuclear reactors.

ENNU 799 Master's Thesis Research (1-6 credits)

ENNU 898 Pre-Candidacy Research (1-8 credits)

ENNU 899 Doctoral Dissertation Research (1-8 credits)

Engineering, Professional Masters (ENPM)

ENPM 600 Probability and Stochastic Processes for Engineers (3 credits)
Prerequisite: Undergraduate introduction to discrete and continuous probability.
Axioms of probability; conditional probability and Bayes' rule; random variables, probability distributions and densities; functions of random variables; definition of stochastic process; stationary processes, correlation functions, and power spectral densities; stochastic processes and linear systems; estimation and optimum filtering. Applications in communication and control systems, signal processing, and detection and estimation.

ENPM 601 Analog and Digital Communication Systems (3 credits)
Prerequisite: ENPM600; or students who have taken courses with comparable content may contact the department.
Analog modulation methods including AM, DSBSC-AM, SSB, and QAM; effects of noise in analog modulation systems. Digital communication methods for the infinite bandwidth additive white Gaussian noise channel: PAM, QAM, PSK, FSK modulation; optimum receivers using the MAP principle; phase- locked loops; error probabilities. Digital communication over bandlimited channels: intersymbol interference and Nyquist's criterion, adaptive equalizers, symbol clock and carrier recovery systems, trellis coding.

Spread spectrum systems: direct sequence modulation and frequency hopping.

ENPM 602 Data Networks (3 credits)

Prerequisite: ENEE324; or students who have taken courses with comparable content may contact the department.

Principles of network design, circuit switching and packet switching, OSI Reference Model; parity and cyclic redundancy check codes; retransmission request protocols; Markov chains and queuing models for delay analysis; multiaccess communication, local area networks, Ethernet and Token Ring standards; routing, flow control, internetworking; higher layer functions and protocols. Software tools for network simulation and performance analysis will be used.

ENPM 603 Theory and Applications of Digital Signal Processing (3 credits)

Prerequisite: Undergraduate introduction to discrete-time systems.

Uniform sampling and the sampling theorem; the Z-transform and discrete-time system analysis; multi-rate systems; discrete-time random processes; methods for designing FIR and IIR digital filters; effects of quantization and finite work-length; the DFT and FFT; power spectrum estimation.

ENPM 604 Wireless Communication Networks (3 credits)

Prerequisite: ENEE426 and ENEE420.

Issues in the design and analysis of wireless communication systems. Aspects of radio propagation, signal strength, multipath propagation, fading, diversity reception, cell shapes. Modulation and coding for the mobile radio channel including FDMA, TDMA, and CDMA. Multiaccess issues including frequency allocation, channel reuse, and power control. System level issues including traffic engineering, blocking, network design and optimization, channel allocation control, handoffs, mobility management, registration and tracking, signaling and user location database management. Examples of existing analog and emerging digital cellular standards.

ENPM 605 Information Theory and Coding (3 credits)

Prerequisite: A course in probability and some knowledge of random processes.

This course will study communication systems from a mathematical viewpoint and with the framework set up by Claude Shannon in 1948. This is achieved by viewing the information being communicated and also the noise and other disturbances in a communication system as stochastic processes and phenomenas. Information theory then shows, through a number of elegant coding theorems, the optimum performance that can be achieved with any communication system

ENPM 607 Computer System Design and Architecture (3 credits)

Prerequisite: ENEE446; or students who have taken courses with comparable content may contact the department.

Principles of computer design and cost/performance factors; instruction set design and implementation, RISC vs. CISC instruction sets; control unit and pipeline design; floating-point arithmetic; memory hierarchy designs, caches, memory interleaving, virtual memory; I/O device interconnections to CPUs and main memory. Additional topics include parallel system designs, SIMD, MIMD, SPMD; interconnection networks for processors and memories; optimization of pipeline operations; superscalar architectures, power management techniques.

ENPM 609 Microprocessor-Based Design (3 credits)

Prerequisite: Must have completed undergraduate courses in logic design, computer architecture, and programming.

Introduction to microprocessor components, software, and tools. Architectures, instruction sets, and assembly language programming for a commercial microprocessor family. Real-time programming techniques. Peripheral chips such as, parallel ports, counter-timers, DMA controllers, interrupt controllers, and serial communication units. Design projects emphasizing intergrated hardware and software solutions to engineering problems.

ENPM 610 Digital VLSI Design (3 credits)

Prerequisite: Must have completed undergraduate courses in solid state devices and digital/analog circuit design.

VLSI design with emphasis on CMOS technology. Logic functions using CMOS switches; MOSFET characteristics; BiCMOS, dynamic logic and domino logic structures; PLA's, FPLA's, and gate arrays; layout via MAGIC, use of VHDL, IRSIM, and Spice; design rules and verification techniques; packaging techniques; chip design options: standard cells, sea-of-gates, full custom; design capture and verification tools; design of CMOS datapaths, memory, and control; possible fabrication via MOSIS.

ENPM 611 Software Engineering (3 credits)

Prerequisite: Competency in one programming language; and must have completed an undergraduate software engineering course. Or permission of instructor. Restriction: Permission of ENGR-CDL-Office of Advanced Engineering Education.

Software engineering concepts, methods, and practices important to both the theorist and the practitioner will be covered. The entire range of responsibilities expected of a software engineer are presented. The fundamental areas of requirements development, software design, programming languages, and testing are covered extensively. Sessions on supporting areas such as systems engineering, project management, and software estimation are also included.

ENPM 612 System and Software Requirements (3 credits)

Prerequisite: ENPM611. Restriction: Permission of ENGR-CDL-Office of Advanced Engineering Education.

Focus will be placed on the theoretical and practical aspects of requirements development. Students will recognize the place of requirements, how to work with users, requirements methods and techniques, the various requirements types, how to set requirements development schedules, requirements evolution, how to model and prototype requirements, how to evaluate and manage risk in requirements, techniques to test requirements, how to manage the requirements process, and how to write an effective requirements document.

ENPM 613 Software Design & Implementation (3 credits)

Prerequisite: ENPM611. Restriction: Permission of ENGR-CDL-Office of Advanced Engineering Education.

Software design concepts and practices within the field important to both the practitioner and the theorist will be covered. Architectural and detailed designs are included for batch, client/server, and real-time systems. Design considerations for structured, object-oriented, and Web-based systems are covered. Design of databases, user interfaces, forms, and reports are also included. Implementation issues that affect the design, including error handling, performance, and inter-process communication, are presented.

ENPM 614 Software Testing & Maintenence (3 credits)

Prerequisite: ENPM611. Restriction: Permission of ENGR-CDL-Office of Advanced Engineering Education.

Aspects of software development after coding is completed will be covered. Students will understand the various levels of testing, techniques for creating test data, how to manage test cases and scenarios, testing strategies and methods, testing batch, client/server, real-time, and Internet systems, and the development of an effective test plan. Software maintenance will include the creation of easily maintained software; preventive maintenance, corrective maintenance, and enhancements; configuration

management practices; and assuring quality in software manintenance.

ENPM 615 Embedded Systems (3 credits)

Prerequisite: Must have completed undergraduate courses in logic design, computer architecture, and programming. Credit only granted for: ENPM 808C or ENPM 615. Formerly: ENPM 808C.

Introduction to embedded systems design and evaluation: requirements, specification, architecture, hardware and software components, integration and performance evaluation. Topics include instruction sets, CPU, embedded computing platform, program design and analysis, operating systems, hardware accelators, multiprocessors, networks, and system analysis. Real-life embedded systems design examples will be used throughput the course to illustrate these concepts.

ENPM 616 Wireless Communications: Concepts and Technologies (3 credits)

Credit only granted for: ENPM 616 or ENPM 808T. Formerly: ENPM 808T.

Advanced topics in wireless communications for voice, data, and multimedia. Overview of current wireless systems and standards followed by characterizing the wireless channel, including path loss for different environments, random log-normal shadowing due to signal attenuation, and the flat and frequency-selective properties of multipath fading. Fundamental capacity limits of wireless channels and the characteristics of the capacity-achieving transmission strategies. Overview of wireless networks, including multiple and random access techniques, WLANs, cellular system design, and ad-hoc network design. Applications for these systems, including the evolution of cell phones and PDAs, smart homes and appliances, sensor networks, and automated highways and skyways.

ENPM 620 Computer Aided Engineering Analysis (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education.

Computer assisted approach to the solution of engineering problems. Review and extension of undergraduate material in applied mathematics including linear algebra, vector calculus, differential equations, and probability and statistics.

ENPM 621 Heat Pump and Refrigeration Systems Design Analysis (3 credits)

Thermal engineering of heat pump and refrigeration systems and thermal systems modeling. Thermodynamics and heat transfer. Cycle analysis, alternative refrigerants, graphical analysis using property charts. Analysis of applications such as space conditioning, food preservation, manufacturing, heat recovery and cogeneration.

ENPM 622 Energy Conversion I - Stationary Power (3 credits)

Thermal engineering of modern power generation systems. Cycle analysis of various modern power generation technologies including gas turbine, combined cycle, waste burning and cogeneration. Energy storage and energy transport.

ENPM 623 Control of Combustion Generated Air Pollution (3 credits)

Analysis of the sources and mechanisms of combustion generated air pollution. Air pollution due to internal combustion engines, power generation and industrial emissions. Techniques to minimize and control emission. Acid rain, ozone, plume analysis, scrubbing, filtering.

ENPM 624 Renewable Energy Applications (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education.

Thermodynamics and heat transfer of renewable energy sources for heating, power generation and transportation. Wind energy, solar thermal, photovoltaic, biomass, waste burning, and hydropower. Broad overview of the growing use of renewable energy sources in the world economy with detailed analysis of specific applications.

ENPM 625 Heating, Ventilation and Air Conditioning of Buildings (3 credits)

Low pressure side of buildings heating and cooling systems. Thermodynamics, heat transfer and digital control principles applied to field problems. Quantitative analyses stressed. Topics include psychometrics, thermal loads, incompressible flow in ducts and pipes, heat exchangers, cooling towers, PID control systems.

ENPM 626 Waste to Energy Conversion (3 credits)

Prerequisite: ENES232, ENME331, and ENME332.

Thermal, chemical, and biological processes for conversion of wastes (primarily solid and liquid) to reduce environmental impact and increase recovery of useful energy resources. Emphasis on solid wastes and their composition. Identification of pollution products and their control.

ENPM 627 Environmental Risk Analysis (3 credits)

The fundamental methodology for analyzing environmental risk is described with examples for selected applications. Key elements of the environmental risk methodology include: (1) source term and release characterization, (2) migration of contaminants in various media, (3) exposure assessment, (4) dose-response evaluation, (5) risk characterization, and (6) risk management. Also included will be an introduction to uncertainty analysis and environmental laws and regulations. It is intended to provide students with the basic skills and knowledge needed to manage, evaluate, or perform environmental risk assessments and risk analyses.

ENPM 631 TCP/IP Networking (3 credits)

Prerequisite: ENPM602; or permission of instructor. Credit only granted for: ENPM808F or ENPM631. Formerly: ENPM808F.

Describe how IP datagram travels through the internet and are routed from the source to the destination. Introduce the two transport protocols: UDP and TCP, the proper context to use each one, and related parameters and issues. Cover some other protocols, closely related to the TCP/IP that are responsible for the seamless operation of the Internet.

ENPM 632 Advanced TCP/IP Networking (3 credits)

Prerequisite: Must have completed ENPM 631 or ENPM 808F, or permission of the instructor. Credit only granted for: ENPM 808E or ENPM 632. Formerly: ENPM808E.

Introduction to the Socket Interface and network programming, advanced topics in IPv6, internet security, advanced topics in TCP performance, and congestion management, creating a simple web server, mobile IP, IP switching and MPLS, voice over IP and QoS, advanced use of Wireshark (statistics and graphs)

ENPM 633 Aquatic Chemistry Concepts (3 credits)

Restriction: Permission of instructor; and permission of ENGR-Office of Advanced Engineering Education.

Development of the theoretical basis for understanding the chemical behavior of aquatic systems, with an emphasis on problem solving. Principles of inorganic and physical chemistry applied to quantitative description of processes in natural waters: Thermodynamic and kinetic aspects of electrolyte solutions, carbon dioxide/carbonate systems; dissolution and precipitation, metalligand complexes, and oxidation/reduction.

ENPM 635 Thermal Systems Design Analysis (3 credits)

Evaluates the trade-offs associted with thermal systems. Use of software for system simulation, evaluation and optimization. Applications include power and refrigeration systems, electronics cooling, distillation columns, dehumidifying coils, and co-generation systems.

ENPM 636 Unit Operations of Environmental Engineering (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education.

Properties and quality criteria of drinking water as related to health are interpreted by a chemical and biological approach. Legal aspects of water use and handling are considered. Theory and application of aeration, sedimentation, filtration, centrifugation, desalinization, corrosion and corrosion control are among topics to be considered.

ENPM 637 Biological Principles of Environmental Engineering (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education.

An examination of biological principles directly affecting society and the environment, with particular emphasis on microbiological interactions in environmental engineering related to air, water and land systems; microbiology and biochemistry of aerobic and anaerobic treatment processes for aqueous wastes.

ENPM 641 Systems Concepts, Issues, and Processes (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education. Also offered as: ENSE621. Credit only granted for: ENPM641 or ENSE621.

An introduction to the professional and academic aspects of systems engineering. Topics include: systems engineering activities, opportunities and drivers; case studies of systems failures; models of system lifecycle development; introduction to model-based systems engineering; representations for system structure, system behavior, system interfaces and systems intergration; reactive (even-driven) systems, systems-of-systems, measures of system complexity; visual modeling of engineering systems with UML and SysML; simplified procedures for engineering optimization and tradeoff analysis. Software tools for visual modeling of systems with UML and SysML. Students will complete a project for the front-end development of an engineering system using ULM/SysML.

ENPM 642 Systems Requirements, Design and Trade-Off Analysis (3 credits)

Prerequisite: ENPM641 or ENSE621; or permission of ENGR-Office of Advanced Engineering Education. Also offered as: ENSE622. Credit only granted for: ENPM642, ENSE602, or ENSE622.

This course builds on material covered in ENSE621/ENPM641, emphasizing the topics of requirements engineering, system-level design and trade-off analysis. Topics include: requirements engineering processes; representation and organization of requirements; implementation and applications of traceability; capabilities of commercial requirements; engineering software; system-level design; design structure matrices; principles of modular design; component- and interface-based design methods; multi-objective optimization-based design and tradeoff; approaches to system redesign in response to changes in requirements, reliability, trade-off analysis,and optimization-based design. Students will complete a project focussing on the development of requirements and their traceability to the system-level design of an engineering system.

ENPM 643 Systems Projects, Validation and Verification (3 credits)

Prerequisite: ENSE622 or ENPM642; and permission of ENGR-Office of Advanced Engineering Education. Also offered as: ENSE623. Credit only granted for: ENPM642 or ENSE623.

This course builds on material covered in ENSE621/ENPM641 and ENSE622/ENPM642. Topics wil cover established and emerging approaches to system validation and verification including; inspection, testing, and traceability; writing validation and verification plans; formal approaches to sytem validation and verification; specification-based testing; role of logic in system validation and verification; automation models of computation, timed automation; model-based design and model checking for reactive systems. Students will be introduced to software tools for specification-based testing, model-based testing, model-based design and model checking. Students will work in teams on semester-long projects in systems engineering design and formal approaches to system validation and verification.

ENPM 644 Human Factors in Systems Engineering (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education. Also offered as: ENSE624. Credit only granted for: ENPM644 or ENSE624.

This course covers the general principles of human factors, or ergonomics as it is sometimes called. Human Factors (HF) is an interdisciplinary approach for dealing with issues related to people in systems. It focuses on consideration of the characteristics of human beings in the design of systems and devices of all kinds. It is concerned with the assignment of appropriate functions for humans and machines, whether the people serve as operators, maintainers, or users of the system or device. The goal of HF is to achieve compatibility in the design of interactive systems of people, machines, and environments to ensure their effectiveness, safety and ease of use.

ENPM 646 System Life Cycle Cost Analysis and Risk Management (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education. Also offered as: ENSE626. Credit only granted for: ENPM646 or ENSE626.

This course covers topics related to estimating the costs and risks incurred through the lifetimes of projects, products and systems. In addition, treatment is given to methods that determine the drivers of costs and risks and facilitate determination of the most effective alternatives to reducing them. Relevant analytic tools from probability and statistics and important managerial and organizational concepts. Extensive use is made of case studies from industry andgovernment.

ENPM 647 Systems Quality and Robustness Analysis (3 credits)

Prerequisite: Permission of ENGR-Office of Advanced Engineering Education. Also offered as: ENSE627. Credit only granted for: ENPM647 or ENSE627.

This course covers systems engineering approaches for creating optimal and robust engineering systems and for quality assurance. It provides an overview of the important tools for quality analysis and quality management of engineering systems. These tools are commonly used in companies and organizations. Focus is placed on the Baldrige National Quality Program, ISO 9000 certification, six-sigma systems, and Deming total quality management to examine how high quality standards are sustained and customer requirements and satisfactions are ensured. The Taguchi method for robust analysis and design is covered and applied to case studies. Issues of flexible design over the system life cycle are addressed. Statistical process control, international standards for sampling, and design experimentation are also studied.

ENPM 650 Solar Thermal Energy Systems (3 credits)

Covers a review of related fundamentals, including limitations imposed by thermodynamics, solar spectral characteristics, measurement, and analytical models to predict solar irradiance with respect to time, location and orientation. The course will then examine the characteristics of various components in solar thermal systems with particular emphasis on flat plate and concentrating collectors, fixed and tracking collector systems, heat exchangers and thermal storage to understand how they work and how their performance is influenced by their design. The course will then lead to an examination of systems and system performance, including system design, predicted energy savings and related economics. The course will introduce low temperature applications such as solar hot water, space heating and water distillation, as well as concentrating solar energy for

solar thermo-chemical processes to produce hydrogen and solar power generation systems. A project of importance to the development of Solar Thermal Power Systems will be assigned.

ENPM 651 Heat Transfer for Modern Application (3 credits)

The applications selected will vary widely: from cooling of electronics to prevention of fog and stalagmite formation in ice rinks. Multi-mode (i.e. simultaneous conduction, convection, radiation, mass transfer) problems will be emphasized. Lectures on basic principles, followed by assignments in which students formulate solutions and explain results.

ENPM 652 Applied Finite Element Methods (3 credits)

Restriction: Must not have completed ENME674; and must not have completed ENAE652. Credit only granted for: ENME674, ENAE652, or ENPM652.

For engineering and science students with little or no previous knowledge of the FEM. Study of FEM, using straightforward mathematics. Students should understand basic concepts and equations of elasticity and thermal heat flow, be familiar with simple matrix algebra. Covers stress analysis and thermal analysis problems. ANSYS finite element code will be used for examples and homework solutions. Basic problem solving procedure will be developed for using finite element computer codes.

ENPM 653 Environmental Law for Engineers and Scientists (3 credits)

Provide engineers and scientists with a general understanding of the U.S. legal system and key aspects of environmental law. Many engineers and scientists today find that environmental regulatory issues are components of their professional work. This course will familiarize them with the major federal environmental statutes and regulations and some of the compliance issues they may face. The topics of engineers and scientists serving as expert witnesses in lawsuits, preparation of environmental and expert reports, and how technical information is used in the courtroom will also be discussed.

ENPM 654 Energy Systems Management (3 credits)

Covers a wide range of energy management and energy efficiency topics including energy auditing, energy efficient lighting systems and motors, demand limiting and control, control strategies for optimization, direct digital control, integrated building automation systems, communication networks, distributed generation, cogeneration, combined heat and power, process energy management and the associated economic analyses. Included will be the latest internet based technologies for accessing real-time energy pricing and managing energy demand remotely for multiple buildings or campuses.

ENPM 655 Contaminant Transport and Fate in the Environment (3 credits)

Prerequisite: Basic chemistry, physics and mathematics, including some calculus; knowledge of organic chemistry will be helpful.

Introduces the physics and chemistry of contaminant migration in various environmental media, including surface water, groundwater, and air. The characteristics of each of these environmental media will be described; then, based on the unique aspects of each medium, the physical, chemical, and biological processes controlling transport in each will be presented. An interdisciplinary approach integrates principles of engineering and natural science to provide both the scientific basis and the quantitative description of contaminant migration, with focus on application of intuitively-based models. Topics include: nature of environmental media, fundamental principles of mass transport, and chemical transformation in various media. Fundamental principles of chemistry, physics, and chemical engineering will be used to derive and apply simple models describing physiochemical transformations of contaminants and their transfer from one medium to another. This course intends to provide students with the basic skills and knowledge needed to manage, evaluate, and/or perform contaminant fate and transport analyses.

ENPM 656 Energy Conversion II -- Mobile Power (3 credits)

Presents the scientific and engineering basis for design, manufacture, and operation of thermal conversion technologies utilized for mobility power generation. The interface between fuel combustion chemistry and generated power are addressed. The practical aspects of design and operation of various alternatives for power are compared. The impact of choices with regard to power and fuel alternatives as well as air pollution potential are also considered.

ENPM 660 Wind Energy Engineering (3 credits)

Credit only granted for: ENPM808Q or ENPM660. Formerly: ENPM808Q.

An examination of four central topics in wind energy engineering: the nature of wind energy as a resource for generating electricity; the aerodynamics of wind turbines by which the wind energy is converted into mechanical energy; the mechanics and dynamics of the wind energy system (tower, rotor, hub, drive train, and generator); and the electrical aspects of wind turbines. Additional topics to be included in the course include:Wind turbine design; wind turbine control; wind turbine siting, system design, and integration; Wind energy system economics; and wind energy systems environmental impacts and aspects. The course is intended to pass along substantial subject matter knowledge and skills, it can only be treated as an introduction to this extensive, multidisciplinary topic. However, students are expected to emerge with a substantial knowledge of wind energy systems and the methods used to analyze such systems.

ENPM 662 Introduction to Robot Modeling (3 credits)

Credit only granted for: ENPM662 or ENPM808M. Formerly: ENPM808M.

This course introduces basic principles for modeling a robot. Most of the course is focused on modeling manipulators based on serial mechanisms. The course begins with a description of the homogenous transformation and rigid motions. It then introduces concepts related to kinematics, inverse kinematics, and Jacobians. This course then introduces Eulerian and Lagrangian Dynamics. Finally, the course concludes by introducing basic principles for modeling manipulators based on parallel mechanisms. The concepts introduced in this course are subsequently utilized in control and planning courses.

ENPM 666 Groundwater Hydrology and Pollution Control (3 credits)

A study of factors affecting groundwater systems including theories and mechanisms governing the groundwater movement and groundwater quality, with particular emphasis on groundwater hydrology and groundwater quality protection in maintaining a sustainable groundwater resource.

ENPM 667 Control of Robotic Systems (3 credits)

Credit only granted for: ENPM667 or ENPM808Q. Formerly: ENPM808Q.

This is a basic course on the design of controllers for robotic systems. The course starts with mainstay principles of linear control, including a review of elementary concepts of systems, and discusses applications to independent joint control. The second part of the course introduces a physics-based approach to control design that uses energy and optimization principles to tackle the design of controllers that exploit the underlying dynamics of robotic systems. The course ends with an introduction to force control and basic principles of geometric control if time allows.

ENPM 670 Advanced Energy Audit and Conservation (3 credits)

Prerequisite: Students are expected to have prior knowledge of undergraduate basic thermodynamics, heat transfer, and thermal transport/heat transfer processes. Knowledge of electrical systems and controls is desirable. Credit only granted for: ENPM670 or ENPM808W. Formerly: ENPM808W.

Students will be provided with current and

future trends in energy resources and technologies while providing them with the necessary skills to conduct energy audit/analysis on both commercial and residential facilities. Energy accounting procedures for electrical, mechanical and HVAC systems will be covered in detail, along with economics/life-cycle costing analysis. Fundamental building science principles will be introduced in the context of energy auditing. Students will gain hands on experience conducting an energy audit project through assigned projects. Annual building simulation tools, such as EnergyPlus and eQuest, will be introduced. This is an applied course. Successful completion of this course will equip students with the terminology, knowledge and practical experience necessary to perform energy audits in both residential and commercial buildings.

ENPM 671 Advanced Mechanics of Materials (3 credits)

Formulate and quantitatively state the mechanical/physical responses of structural components and configurations subjected to loads, temperature, pre-strains etc. The two methods of anlysis employed are the mechanics of materials approach and the theory of elasticity approach. Analysis and design of components of structural/machine systems as experienced in aeronautical, civil, mechanical and nuclear engineering.

ENPM 672 Fundamentals for Thermal Systems (3 credits)

Prerequisite: Undergraduate engineering, physics or chemistry degree. Restriction: Permission of ENGR-Office of Advanced Engineering Education.

Included in this course is an introduction to thermodynamics, fluid mechanics and heat transfer. Emphasis is on gaining an understanding of the physical concepts through the solving of numerical problems associated with simple thermal fluid processes and cycles. Both ideal gases and multiphase fluids will be considered as the working fluids.

ENPM 673 Perception for Autonomous Robots (3 credits)

Credit only granted for: ENPM673 or ENPM808T. Formerly: ENPM808T.

Image Processing and Computer Vision techniques for Mobile Robots is taught. Three topics are covered: Image Processing (Image Enhancement, Filtering, Advanced Edge and Texture), 3D Vision (3D Geometry from Multiple view geometry, Motion Processing and Stereo) and an Introduction to Image Segmentation and Object Recognition. Students are introduced to a number of existing software toolboxes from Vision and Robotics, and will implement a number of smaller projects in Matlab.

ENPM 674 Design and Synthesis of Digital Systems (3 credits)

Credit only granted for: ENPM808R or ENPM674. Formerly: ENPM808R.

Students will be introduced to HDL-based design of modern digital systems, and will cover in depth the design and implementation of digital systems using the Verilog HDL. Students will learn fundamental concepts of the Verilog language; modeling of complex digital systems; simulation and verification; and Verilog coding styles for synthesis. Hands-on experience will be developed through practical designs, exercises, and projects. Students will use state-of-the-art EDA tools to design, simulate, and test digital systems. The latter part of the course will focus on customized programmable platforms such as graphics processors (GPUs) multicore platforms and FPGAs as well as coding, building, and debugging for such platforms.

ENPM 675 Operating System Design (3 credits)

Prerequisite: Undergraduate coursework in computer organization and assembly language programming.

An overview that covers process management (processes and threads, process scheduling, and process synchronization and communication), memory management (main and virtual), storage management (file and I/O), and protection and security.

ENPM 676 VLSI Testing and Design for Testability (3 credits)

Prerequisite: ENEE244; or students who have taken courses with comparable content may contact the department.

An overview of VLSI test process and equipment, faults, fault modeling, fault simulation, combinational logi ATPG, sequential logic ATPG, Iddq testing, function testing, memory testing, delay testing, design for testability, BIST (Built-In Self-Test) and boundary scan.

ENPM 677 Wireless Sensor Networks (3 credits)

Focuses on networking aspects, protocols and architectures for Wireless Sensor Networks. Provides a thorough description of the most important issues and questions that have to be addressed in a wireless sensor neto work.

ENPM 680 Aquatic Chemical Kinetics (3 credits)

Restriction: Permission of instructor.

The objective is to strengthen the understanding of reaction mechanisms and specific reaction rates in natural and engineered water system (fresh water, atmospheric water, porous water and ocean). The class will also introduce innovative researches developed in water technology.

ENPM 681 Shockwave Physics I (3 credits)

Covers the history of Shock Wave Physics becoming a scientific discipline, conservation equations for one-dimensional plane steady shocks, Eulerian coordinate system, wave stability conditions, impedance matching technique for design and analysis of experiments, select group of experimental techniques, experimental error analysis, thermodynamics of shock waves including use of consistent equations of state, derivation of plane one dimensional differential conservation laws, and uniqueness of steady wave profiles.

ENPM 682 Shockwave Physics II (3 credits)

Prerequisite: ENPM681.

Elastic-plastic solids, phase transitions, porous solids, materials with time-dependent properties, detonation waves in Ideal explosives, detonation waves in cylinders of non-ideal explosives, shock initiation of high explosives, experimental techniques for measuring detonation wave properties, Lagrangian coordinate system, ramp wave and raditiaton loading of material.

ENPM 683 Chemistry of Energetic Materials (3 credits)

Recommended: Background in general chemistry is strongly desired.

An introduction to the chemistry of energetic materials (explosives, propellants, and pyrotechnics), organized by traditional functional groups. Primary and secondary explosives, including the properities and syntheses of nitrate esters, nitramines, and nitro compounds, as well as other energetic compunds will be discussed. Other topics discussed are: crystallization, polymorphism, sensitivity, and various explosive and propellant compositions.

ENPM 684 Rocket Propulsion (3 credits)

Review of basic rocket propulsion principles including performance, design, analysis, nozzle theory, and thermodynamic relationships. Students will conduct performance analyses of solid, liquid, and hybrid rocket motors. Design projects will be focused to allow students to develop a basic understanding for the challenges associated with the design of chemical rocket engines/motors. We will examine the classification of solid and liquid propellants/fuels/oxidizers and their combustion characteristics.

ENPM 685 Security Tools for Information Security (3 credits)

Prerequisite: Familiarity with Linux and Windows operating systems, as well as TCP/IP and basic networking concepts. Credit only granted for: ENPM808D or ENPM685. Formerly: ENPM808D.

Students will perform host- and network-based security tasks relating to security, investigation, compliance verification and auditing using a wide selection of commonly used tools on both Windows and Linux platforms, with emphasis on open source tools.

ENPM 686 Information Assurance (3 credits)

Credit only granted for: ENPM808E or ENPM686. Formerly: ENPM808E.
The first half of lectures provides an overview of cybersecurity. One third of these lectures focuses on the fundamentals of cybersecurity like authentication, access control, and security models. The second third focuses on the practice of cybersecurity using Unix and Windows NT as case studies. The last third is dedicated to security in distributed systems including network security, and World Wide Web security. The second half of the lectures focuses on the information assurance process. First, information assets are enumerated and classified. Second, the main vulnerabilities and threats are identified. Third, a risk assessment is conducted by considering the probability and impact of the undesired events. Finally, a risk management plan is developed that includes countermeasures involving mitigating, eliminating, accepting, or transferring the risks, and considers prevention, detection, and response.

ENPM 687 Digital Forensics and Incidence Responses (3 credits)

Prerequisite: Intermediate Windows and Linux skills, familiarity with file system concepts. Credit only granted for: ENPM808P or ENPM687. Formerly: ENPM808P.
Students will implement a robust incident response methodology, including proper forensic handling of evidence, and cover legal aspects of national and international law regarding forensics. The bulk of the course covers evidence acquisition, preservation, analysis and reporting on multiple platforms.

ENPM 693 Network Security (3 credits)

Prerequisite: An operating systems and/or network protocol course or equivalent. Formerly: ENPM808N.
Introduction to various approaches to design; specify and verify security protocols used in large systems and networks; familiarization with some current technologies. Security threats and countermeasures, communication security and basic encryption techniques, authentication protocols, data confidentiality and integrity, analysis of cryptographic protocols, and access control in large systems and networks.

ENPM 694 Networks and Protocols (3 credits)

Credit only granted for: ENPM694 or ENPM808A. Formerly: ENPM808A.
Provides a deep understanding of TCP/IP protocol suit and routing in the internet. The course topics are: overview of TCP/IP, basics of IP protocol, basics of TCP protocol, Network Address Translation (NAT), Dynamic Host Configuration Protocol (DHCP), Internet Protocol Security (IPsec), Internet Control Message Protocol (ICMP), Simple Mail Transfer Protocol (SMTP), Domain Name Service (DNS), IPv6, Concepts of routing (Bellman-Ford and Dijkstra algorithms), Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Interior Gateway Routing Protocol (IGRP), Enhance Gateway Routing Protocol (EIGRP), and Border Gateway Protocol (BGP).

ENPM 695 Secure Operating Systems (3 credits)

Prerequisite: ENPM691; and CMSC106. Or permission of instructor. Credit only granted for: ENPM695 or ENPM808B. Formerly: ENPM808B. Additional information: This course assumes knowledge of C programming and a previous operating systems class or knowledge in various issues such as process management, process synchronization, the critical section problem, CPU scheduling, memory management, secondary storage management.
Operating systems are the basic building block on which programmers build applications and on which security-minded professionals rely, whether they are monitoring activity on a computer, testing applications for security, or determining how malicious code affected their network. This course covers advanced topics in operating systems including process management and communication, remote procedure calls, memory management (including shared memory and virtual memory), checkpointing and recovery, file system, I/O subsystem and device management, distributed file systems and security. The course consists of reading and discussing research papers and includes a course project.

ENPM 696 Reverse Software Engineering (3 credits)

Prerequisite: ENPM691; and CMSC106. Or permission of instructor. Credit only granted for: ENPM808F or ENPM696. Formerly: ENPM808F.
Students will be provided with in-depth, hands-on training for reverse engineering tools, including the IDA Pro disassembler, the Wireshark network protocol analyzer, debuggers, and binary tools. Students will become familiar with the x86 instruction set through both assembly programming and disassembly. Class exercises include revealing back doors and exploiting buffer overflows. Each student will develop a network-based application and in turn reverse engineer and exploit one of their peer's completed applications.

ENPM 697 Secure Software Testing and Construction (3 credits)

Prerequisite: ENPM691; and CMSC106. Or permission of instructor. Credit only granted for: ENPM808K or ENPM697. Formerly: ENPM808K.
As software gets more complex, there is even more potential for vulnerabilities to remain in the production version. While traditional and emerging software testing methods are very good at detecting a large majority of "bugs" in the software, modifications to the methods are necessary to ensure vulnerabilities related to security are discovered and mitigated prior to release. In industry, there is also a cost-benefit analysis that determines the limits to pre-release testing, further enforcing the need to uniquely identify security vulnerabilities, potentially prioritizing their correction over other vulnerabilities. This course will cover methods of building security in from the beginning of development and testing the resulting software to ensure security vulnerabilities are detected. The course will use a mixture of textbook principles and research papers to cover the concepts. Students will also complete a course project.

ENPM 808 Advanced Topics in Engineering (1-3 credits)

Advanced topics selected by the faculty for students in the professional master of engineering program. May be taken for repeated credit when identified by topic title.

Engineering and Public Policy (ENPP)

ENPP 610 MEPP Capstone (3 credits)

Prerequisite: Permission of ENGR-A. James Clark School of Engineering; and must have completed or be concurrently enrolled in ENCE611.
MEPP Students, in the last year of their program, will learn case study methods of analysis as they relate to issues of engineering and public policy, through case studies on pressing issues in areas such as environment, national security, biotechnology, energy, infrastructure, development and manufacturing. The course will begin by review of case study methods and analysis. This will be followed by addressing case studies selected by the instructor.

ENPP 611 MEPP Scholarly Practicum (3 credits)

Restriction: Must have Practicum Proposal approved by MEPP.
The scholarly practicum internship for MEPP students is intended to educate students in how engineering and public policy is practised in their MEPP specialization. The internship must last a minimum of 400 hours, and must be completed by the submission and approval of progress and completion reports. By undertaking the internship midway through the student's MEPP studies, the student can make use of MEPP studies completed, and use the experience in selection of subsequent MEPP course to maximize the educational opportunities of the MEPP program.

Reliability Engineering (ENRE)

ENRE 447 Fundamentals of Reliability Engineering (3 credits)

Credit only granted for: ENRE445 or ENRE447. Formerly: ENRE445.

Topics covered include: fundamental understanding of how things fail, probabilistic models to represent failure phenomena, life-models for non-repairable items, reliability data collection and analysis, software reliability models, and human reliability models.

ENRE 489 Special Topics in Reliability Engineering (3 credits)

Prerequisite: Permission of ENGR-Mechanical Engineering department. Repeatable to 6 credits if content differs.

Selected topics of current importance in reliability engineering.

ENRE 600 Fundamentals of Failure Mechanisms (3 credits)

Credit only granted for: ENMA698M, ENNU648M, or ENRE600.

Physical, chemical, and thermal related failures are introduced through a basic understanding of degradation mechanisms such as diffusion, electromigration, defects and defect migration. The failure mechanisms in basic material types will be taught. Failure mechanisms observed in real devices will also be presented. Problems related to manufacturing, and achieving quality and reliability will be analyzed. Mechanical failures are emphasized from the point of view of complex fatigue theory. The mathematical and statistical basis for analysis is presented as well as Failure Mode and Failure Anaylsis.

ENRE 601 Fundamentals of Failure Mechanisms (3 credits)

Introduces students to basic principles of Reliability Engineering and Reliability Physics. The approach is to provide a general tool set by which engineers can understand how to consider reliability in all phases of the design and manufacture of a product. The emphasis is on integrating statistics and probability with understanding the fundamental physics of processes that lead to failures.

ENRE 602 Reliability Analysis (3 credits)

Principal methods of reliability analysis, including fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis; methods of modeling systems for reliability analysis. Focus on problems related to process industries, fossil-fueled power plant availability, and other systems of concern to engineers.

ENRE 620 Mathematical Techniques of Reliability Engineering (3 credits)

Also offered as: ENNU620.

Basic probability and statistics (required for ENRE 600 and ENRE 602). Application of selected mathematical techniques to the analysis and solution of reliability engineering problems. Applications of matrices, vectors, tensors, differential equations, integral transforms, and probability methods to a wide range of reliability related problems.

ENRE 640 Collection and Analysis of Reliability Data (3 credits)

Prerequisite: ENRE602.

Basic life model concepts. Probabilistic life models, for components with both time independent and time dependent loads. Data analysis, parametric and nonparametric estimation of basic time-to-failure distributions. Data analysis for systems. Accelerated life models. Repairable systems modeling.

ENRE 641 Probabilistic Physics of Failure and Accelerated Testing (3 credits)

Credit only granted for: ENRE641 or ENRE650. Formerly: ENRE650.

Models for life testing at constant stress. Graphical and analytical methods. Test plans for accelerated testing. Competing failure modes and size effects. Models and data analyses for step and time varying stresses. Optimizing of test plans.

ENRE 642 Reliability Engineering Management (3 credits)

Unifying systems perspective of reliability engineering management. Design, development and management of organizations and reliability programs including: management of systems evaluation and test protocols, development of risk management-mitigation processes, and management of functional tasks performed by reliability engineers.

ENRE 645 Human Reliability Analysis (3 credits)

Credit only granted for: ENRE645 or ENRE734. Formerly: ENRE734.

Methods of solving practical human reliability problems, cognitive and behavioral modeling, task analysis, performance shaping factors, error classification, distribution of human performance and uncertainty bounds, sources of human error probability data, human error risk mitigation, examples and case studies.

ENRE 648 Special Problems in Reliability Engineering (1-6 credits)

Repeatable to 6 credits if content differs.

For students who have definite plans for individual study of approved problems. Credit given according to extent of work.

ENRE 655 Advanced Methods in Reliability Modeling (3 credits)

Prerequisite: ENRE602. Credit only granted for: ENRE655 or ENRE665. Formerly: ENRE665.

Bayesian methods and applications, estimation of rare event frequencies, uncertainty analysis and propagation methods, reliability analysis of dynamic systems, analysis of dependent failures, reliability of repairable systems, human reliability analysis methods and theory of logic diagrams and application to systems reliability.

ENRE 657 Telecommunications Systems Reliability (3 credits)

Prerequisite: ENRE602.

Reliability perspectives in telecommunications networks, comparison of networks with respect to operations and reliability, network relibility modeling techniques, applicable procedural/human reliability models, and network metric objectives and data collection.

ENRE 664 Electronic Packaging Materials (3 credits)

Prerequisite: Permission of ENGR-Mechanical Engineering department. Credit only granted for: ENRE648N or ENRE664. Formerly: ENRE648N.

Energy bands and carrier concentration, carrier transport phenomena, p-n junction, bipolar devices, unipolar devices, crystal growth and epitaxy, oxidation and film deposition, diffusion and ion implantation, lithography and etching, integrated devices, electomigration.

ENRE 670 Probabilistic Risk Assessment (3 credits)

Prerequisite: ENRE602. Also offered as: ENNU651. Credit only granted for: ENNU651 or ENRE670.

Why study risk, sources of risk, overview of Risk Assessment and Risk Management, relation to System Safety and Reliability Engineering; measures, representation, communication, and perception of risk; overview of use of risk assessment results in decision making; overview of Probabilistic Risk Assessment (PRA) process; detailed converge of PRA methods including (1) methods for risk scenario development such as identification of initiators, event sequence diagrams, event trees, causal modeling (fault trees, influence diagrams, and hybrid methods), and simulation approaches; (2) methods of risk scenario likelihood assessment, including quantitative and qualitative approaches, as well as uncertainty modeling and

analysis. Also covers methods for risk modeling of system hardware behavior, physical phenomena, human behavior, software behavior, organizational environment, and external physical environment. Additional core topics include risk model integration and quantification (Boolean-based, binary decsion diagram, Bayesian belief networks, and hybrid methods), simulation-based Dynamic PRA methods (discrete and continuous) and several examples of large scale PRAs for space missions, nuclear power, aviation and medical systems.

ENRE 671 Risk Assessment in Engineering (3 credits)

Prerequisite: ENRE670. Credit only granted for: ENRE648W or ENRE671. Formerly: ENRE648W.

Introduction to risk management and decision-making, including uncertainty propagation, importance ranking, risk acceptance criteria, decision analysis and other decsion-making techniques, risk communication.

ENRE 682 Software Reliability and Integrity (3 credits)

Credit only granted for: ENRE682 or ENRE732. Formerly: ENRE732.

Defining software reliability, initiatives and standards on software reliability, inherent characteristics of software which determine reliability, types of software errors, structured design, overview of software reliability models, software fault tree analysis, software redundancy, automating tools for software reliability protypes and real time software reliability.

ENRE 684 Information Security (3 credits)

Also offered as: ENME442. Credit only granted for: ENME442, ENRE648J, or ENRE684. Formerly: ENRE648J.

This course is divided into three major components: overview, detailed concepts and implementation techniques. The topics to be covered are: general security concerns and concepts from both a technical and management point of view, principles of security, architectures, access control and multi-level security, trojan horses, covert channels, trap doors, hardware security mechanism, security models, security kernels, formal specifications and verification, networks and distribution systems and risk analysis.

ENRE 689 Special Topics in Engineering Materials (3 credits)

ENRE 730 Bayesian Reliability Analysis (3 credits)

Foundations of Bayesian statistical inference, Bayesian inference in reliability, performing a Bayesian reliability analysis, Bayesian decision and estimation theory, prior distributions such as non-informative, conjugate, beta, gamma, and negative log gamma, estimation methods based on attribute life test data for estimating failure rates and survival probabilities. System reliability assessment and methods of assigning prior distribution. Empirical Bayes reliability estimates (implicity or explicitly estimated priors).

ENRE 770 Life Cycle Cost and System Sustainment Analysis (3 credits)

Also offered as: ENME770. Credit only granted for: ENME770 or ENRE770.

This course melds elements of traditional engineering economics with manufacturing process and sustainment modeling, and life cycle cost management concepts to form a practical foundation for predicting the cost of products and systems. Various manufacturing cost analysis will be presented including: process-flow, parametric, cost of ownership, and activity based costing. The effects of learning curves, data uncertainty, test and rework processes, and defects will be considered. Aspects of system sustainment including the impact on the life cycle (and life cycle costs) of reliability, maintenance, environment impact, and obsolescence will be treated.

ENRE 798 Master's Non-Thesis Research (1-6 credits)

ENRE 799 Master's Thesis Research (1-6 credits)

ENRE 898 Pre-Candidacy Research (1-8 credits)

ENRE 899 Doctoral Dissertation Research (1-8 credits)

Systems Engineering (ENSE)

ENSE 621 Systems Concepts, Issues, and Processes (3 credits)

Restriction: Permission of ENGR-Institute for Systems Research. Also offered as: ENPM641. Credit only granted for: ENPM641 or ENSE621.

An introduction to the professional and academic aspects of systems engineering. Topics include: systems engineering activities, opportunities and drivers; case studies of systems failures; models of system lifecycle development; introduction to model-based systems engineering; representations for system structure, system behavior, system interfaces and systems intergration; reactive (even-driven) systems, systems-of-systems, measures of system complexity; visual modeling of engineering systems with UML and SysML; simplified procedures for engineering optimization and tradeoff analysis. Software tools for visual modeling of systems with UML and SysML. Students will complete a project for the front-end development of an engineering system using ULM/SysML.

ENSE 622 Systems Requirements, Design and Trade-Off Analysis (3 credits)

Prerequisite: ENPM641 and ENSE621; or permission of ENGR-Institute for Systems Research. Also offered as: ENPM642. Credit only granted for: ENPM642 or ENSE622.

This course builds on material covered in ENSE621/ENPM641, emphasizing the topics of requirements engineering, system-level design and trade-off analysis. Topics include: requirements engineering processes; representation and organization of requirements; implementation and applications of traceability; capabilities of commercial requirements; engineering software; system-level design; design structure matrices; principles of modular design; component- and interface-based design methods; multi-objective optimization-based design and tradeoff; approaches to system redesign in response to changes in requirements, reliability, trade-off analysis,and optimization-based design. Students will complete a project focussing on the development of requirements and their traceability to the system-level design of an engineering system.

ENSE 623 Systems Projects, Validation and Verification (3 credits)

Prerequisite: ENSE622 and ENPM642; and permission of ENGR-Institute for Systems Research. Also offered as: ENPM643. Credit only granted for: ENPM643, ENSE610, or ENSE623.

This course builds on material covered in ENSE621/ENPM641 and ENSE622/ENPM642. Topics wil cover established and emerging approaches to system validation and verification including; inspection, testing, and traceability; writing validation and verification plans; formal approaches to sytem validation and verification; specification-based testing; role of logic in system validation and verification; automation models of computation, timed automation; model-based design and model checking for reactive systems. Students will be introduced to software tools for specification-based testing, model-based testing, model-based design and model checking. Students will work in teams on semester-long projects in systems engineering design and formal approaches to system validation and verification.

ENSE 624 Human Factors in Systems Engineering (3 credits)

Restriction: Permission of ENGR-Institute for Systems Research. Also offered as: ENPM644. Credit only granted for: ENPM644 or ENSE624.

This course covers the general principles of human factors, or ergonomics as it is sometimes called. Human Factors (HF) is

an interdisciplinary approach for dealing with issues related to people in systems. It focuses on consideration of the characteristics of human beings in the design of systems and devices of all kinds. It is concerned with the assignment of appropriate functions for humans and machines, whether the people serve as operators, maintainers, or users of the system or device. The goal of HF is to achieve compatibility in the design of interactive systems of people, machines, and environments to ensure their effectiveness, safety and ease of use.

ENSE 626 System Life Cycle Analysis and Risk Management (3 credits)
Prerequisite: Permission of ENGR-Institute for Systems Research. Also offered as: ENPM646.
This course covers topics related to estimating the costs and risks incurred through the lifetimes of projects, products and systems. In addition, treatment is given to methods that determine the drivers of costs and risks and facilitate determination of the most effective alternatives to reducing them. Also covered, are relevant analytic tools from probability and statistics and also important managerial and organizational concepts. Extensive use is made of case studies and examples from industry and government.

ENSE 627 Systems Quality and Robustness Analysis (3 credits)
Restriction: Permission of ENGR-Institute for Systems Research. Also offered as: ENPM647. Credit only granted for: ENPM647 or ENSE627.
This course covers systems engineering approaches for creating optimal and robust engineering systems and for quality assurance. It provides an overview of the important tools for quality analysis and quality management of engineering systems. These tools are commonly used in companies and organizations. Focus is placed on the Baldrige National Quality Program, ISO 9000 certification, six-sigma systems, and Deming total quality management to examine how high quality standards are sustained and customer requirements and satisfactions are ensured. The Taguchi method for robust analysis and design is covered and applied to case studies. Issues of flexible design over the system life cycle are addressed. Statistical process control, international standards for sampling, and design experimentation are also studied.

ENSE 698 Special Topics in Systems Engineering (3 credits)
Prerequisite: ENSE621; and permission of ENGR-Institute for Systems Research. Repeatable to 6 credits if content differs.

ENSE 699 Directed Study in Systems Engineering (1-3 credits)
Prerequisite: ENSE621, ENSE622, and ENSE623. Repeatable to 3 credits if content differs.
Directed study in Systems Engineering.

ENSE 799 Systems Engineering Thesis (1-6 credits)
Prerequisite: Permission of ENGR-Institute for Systems Research; and ENSE621; and must have 6 additional credits totaling 9 credit hours. Repeatable to 6 credits.
The application of systems engineering concepts, principles, and theories will be applied to the Master's Thesis project. Project/thesis work will be defined and selected early in student's program and supervised by a university faculty mentor.

Environmental Science and Policy (ENSP)

ENSP 400 Capstone in Environmental Science and Policy (3 credits)
Prerequisite: ENSP101; and ENSP102. Restriction: Senior standing; or permission of the Director of ENSP. And must be in Environmental Science and Policy program.
Integration of physical, biological, and social sciences with applications to environmental science and policy. Problem-solving and multi-disciplinary case study evaluations pertinent to contemporary and future issues related to the environment.

ENSP 499 Honors Thesis Research (1-6 credits)
Restriction: Must be in the ENSP Honors program; and permission of AGNR-Dean-Environmental Science & Policy Program. Repeatable to 6 credits.
Individual research, thesis, and oral defense. The research project will be conducted under the supervision of a faculty member.

Environmental Science and Technology (ENST)

ENST 404 Natural Resource and Environmental Ethics (3 credits)
Prerequisite: ENST214 and ENST360. Recommended: ENST314, ENST410, and ENST460. Restriction: Senior standing or higher.
Bridges science and management with ethical theory and concepts to help scientists, regulators, and managers understand how to deal with potential ethical dilemmas that arise in natural resource and environmental management implementation and policy development.

ENST 405 Energy and Environment (3 credits)
Prerequisite: MATH140 or MATH220. Restriction: Junior standing or higher. And must be in Environmental Sci & Tech program; or must be in Environmental Sci & Tech: Ecological Tech Design program; or must be in Environmental Sci & Tech: Environmental Health program; or must be in Environmental Sci & Tech: Soil & Watershed Science program; or must be in Environmental Sci & Tech: Natural Resources Mgmt program. Also offered as: ENST605. Credit only granted for: ENST405, ENSP350, ENST605, NRMT489Z, or MEES698Z. Formerly: NRMT489Z.
Introduction to the role of energy in environmental and human-dominated systems. Discussion of the historical and modern production and consumption of energy. Introduction to energy systems computer simulation and energy auditing.

ENST 406 Applied Forestry Practices (3 credits)
Prerequisite: ENST200. And ENST360; or PLSC471. Also offered as: PLSC475. Credit only granted for: ENST406 or PLSC475.
Focuses on the applied dynamics of a set of forest practices such as management, silviculture, measurement and inventory, preparation of a management plan, etc, within the urban/rural interface. Several field trips are included to gain hands-on experience.

ENST 407 Environmental Plant Physiology (4 credits)
Prerequisite: PLSC100 or PLSC101; or (BSCI106 and BSCI105). Recommended: CHEM131 and CHEM132. Restriction: Junior standing or higher. Also offered as: PLSC400. Credit only granted for: PLSC400 or ENST407.
An introduction to the basic physical and physiological principles necessary for understanding the interactions between plants and their environment. The overall objective is to understand plant responses and adaptions to the environment and the ecological relevance of these responses.

ENST 410 Ecosystem Services: An Integrated Analysis (3 credits)
Prerequisite: ENST360 or BSCI361; or permission of instructor. Restriction: Must be in one of the following programs (Environmental Sci & Tech: Ecological Tech Design; Environmental Sci & Tech; Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci & Tech: Soil & Watershed Science; Environmental Sci

& Tech: Environmental Health).
The importance of our ecosystems and the services they provide will be discussed. Basic principles used to analyze ecosystem services will be discussed and applied using case studies & field exercises. Forestland, wetlands and our marine resources are increasingly recognized for their ecosystem services provided to society, to include clean air and water, wildlife habitat, biodiversity, carbon storage and pollination services. This course will prepare students to deal with the complex issues involved in understanding those and other ecosystem services and their importance to society and environmental sustainability. Slowly, new markets are emerging for these services. Students will analyze the ecological, policy and financial dimensions of enhancing, restoring, and sustaining ecosystem services. New and on-going government programs and private business ventures will be discussed.

ENST 411 Principles of Soil Fertility (3 credits)

Prerequisite: ENST200; or students who have taken courses with comparable content may contact the department. Also offered as: ENST611. Credit only granted for: ENST411 or NRSC411. Formerly: NRSC411.
Soil factors affecting plant growth and quality with emphasis on the bio-availability of mineral nutrients. The management of soil systems to enhance plant growth by means of crop rotations, microbial activities, and use of organic and inorganic amendments.

ENST 414 Soil Morphology, Genesis and Classification (4 credits)

Prerequisite: ENST200. Credit only granted for: ENST414 or NRSC414. Formerly: NRSC414.
Processes and factors of soil genesis. Taxonomy of soils of the world by U.S. System. Soil morphological characteristics, composition, classification, survey and field trips to examine and describe soils.

ENST 415 Renewable Energy (3 credits)

Prerequisite: CHEM131, PHYS121, and MATH113; or permission of AGNR-Environmental Science & Technology department. Restriction: Must be in a major within AGNR-Environmental Science & Technology department.
An overview of renewable energy technologies and their current applications. Emphasis will be placed on technological readiness, efficiency and sustainability of renewable energy alternatives. Technologies include solar thermal, photovoltaics, biodiesel, ethanol, anaerobic digestion, wind, hydroelectric, and microbial fuel cells.

ENST 417 Soil Hydrology and Physics (3 credits)

Prerequisite: ENST200; and (MATH113 or MATH115). Or permission of instructor. Credit only granted for: ENST417 or NRSC417. Formerly: NRSC417.
A study of soil water interactions: the hydrologic cycle; the unique properties of water and soil; the soil components and their interactions; the field water cycle; transport processes involving water, heat and solutes; human effects on soil and groundwater; as well as the measurement, prediction, and control of the physical processes taking place in and through the soil.

ENST 421 Soil Chemistry (4 credits)

Prerequisite: ENST200. Credit only granted for: ENST421 or NRSC421. Formerly: NRSC421.
The chemistry and composition of mineral and organic colloids in soils, including ion exchange, oxidation-reduction, acidity, surface charge, and solution chemistry. Lectures and readings pertain to plant nutrition, waste disposal, and groundwater quality.

ENST 422 Soil Microbial Ecology (3 credits)

Prerequisite: ENST200; or 1 course in BCHM; or must have completed a course in microbiology; or students who have taken courses with comparable content may contact the department. Also offered as: ENST622. Credit only granted for: ENST422 or NRSC422. Formerly: NRSC422.
The interdisciplinary study of soil microorganisms and their interactions with the mineral matrix; resulting in processes such as nutrient cycling, decontamination, and natural product production. We will focus on the diversity of soil communities, their survival strategies, and the new strategies used to study these communities.

ENST 423 Soil-Water Pollution (3 credits)

Prerequisite: CHEM104 and ENST200; and permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST423 or NRSC423.
Reaction and fate of pesticides, agricultural fertilizers, industrial and animal wastes in soil and water with emphasis on their relation to the environment.

ENST 424 Field Study in Soil Morphology (4 credits)

Prerequisite: ENST200. Credit only granted for: ENST424 or NRSC424. Formerly: NRSC424. Additional information: Students must pay a $300 course activities fee.
The fundamentals of making morphological descriptions of soils, using standard techniques, terminology, and abbreviations of the National Cooperative Soil Survey. Given a regional perspective and reasonable assumptions regarding soil properties, students should become competent to classify soils which they have described in the field and also make interpretations concerning the suitability of soils for various potential uses.

ENST 427 Nonpoint Source Pollution Assessment Techniques (3 credits)

Prerequisite: Must have completed one course in hydrology; or permission of AGNR-Environmental Science & Technology department. Also offered as: ENBE462. Credit only granted for: ENBE462 or ENST427.
Various techniques to measure non-point source pollution, quantify mass transport, and statistically evaluate water quality criteria. Primary focus is on agriculture and water, but urban NPS pollution is addressed.

ENST 430 Wetland Soils (3 credits)

Prerequisite: ENST200. Credit only granted for: ENST430, ENST630, or NRSC461. Formerly: NRSC461.
The soils of wetlands including hydrology, chemistry, and genesis are discussed. Federal and regional guidelines for wetland soils are covered with an emphasis on validating interpretations through field observations.

ENST 432 Environmental Microbiology (3 credits)

Prerequisite: BSCI105, CHEM131, and CHEM132. Credit only granted for: ENST432 or ENST499M. Formerly: ENST499M.
Microorganisms are everywhere and mediate many of the processes that we observe everyday. These organisms are the unseen catalysts for numerous industrial processes and are critical to many emerging technologies and novel products. Environmental microbiologists ask: How do microorganisms in the environment benefit society? This course will answer this question by examining microbes in bioremediation, food safety, climate change, and biotechnology.

ENST 434 Toxic Contaminants: Sources, Fate, and Effects (3 credits)

Prerequisite: ENST333 and ENST334.
Study of the release to the environment, transport through natural compartments, persistence and ultimate fate of various classes of contaminants produced as a result of human activities. Topics will culminate in discussions of impacts to wildlife and human health. Students should emerge with a practical appreciation of the actual risks from exposure to a variety of environmental contaminants and an understanding of the

environmental and human health implications of continuing the contaminating activities.

ENST 436 Emerging Environmental Threats (3 credits)
Prerequisite: ENST233; or permission of AGNR-Environmental Science & Technology department.
Examine new and potential environmental concerns in the air, water, soil, space, and the built environment. Emphasis on studying the intrinsic links between ecosystem and human health. Topics will include climate change, resource consumption, biodiversity change, infectious disease, non-traditional pollutants, and other complex and significant environmental concerns.

ENST 440 Crops, Soils and Civilization (3 credits)
Credit only granted for: ENST440 or NRSC440. Formerly: NRSC440.
Role and importance of crop and soil resources in the development of human civilization. History of crop and soil use and management as they relate to the persistence of ancient and modern cultures.

ENST 441 Sustainable Agriculture (3 credits)
Credit only granted for: ENST441 or NRSC441. Formerly: NRSC441.
Environmental, social and economic needs for alternatives to the conventional, high-input farming systems which currently predominate in industrial countries. Strategies and practices that minimize the use of non-renewable resources.

ENST 443 Industrial Ecology (3 credits)
Prerequisite: MATH140 or MATH220; and BSCI361. Or permission of AGNR-Environmental Science & Technology department. Also offered as: ENST643. Credit only granted for: ENST443, ENST643, or MEES698J.
Problems of waste management and recycling in human societies are covered. The industrial ecology approach to design is contrasted with analogous patterns and processes from natural ecosystems.

ENST 444 Restoration Ecology (3 credits)
Prerequisite: MATH140. Credit only granted for: ENST444, NRMT489F, or NRMT444. Formerly: NRMT489F.
Discussion of the philosophies, principles, and practices of ecosystem restoration. Presentation of restoration case histories include wetlands, lakes, streams, coastal systems, mined lands, and new ecosystems.

ENST 445 Ecological Risk Assessment (3 credits)
Prerequisite: ENST360 or BSCI361; and (BIOM301 and ENST334). Or permission of AGNR-Environmental Science & Technology department.
Assessment of ecological impacts of perturbations on natural systems. Course will describe quantitative methods for estimating environmental impacts by extrapolating from laboratory and field data. The role of regulatory agencies and implications of scientific uncertainty on risk management will be covered.

ENST 447 Biodiversity, Ecology, and Human Health (3 credits)
Prerequisite: BIOM301; or permission of AGNR-Environmental Science & Technology department.
An investigation of how biodiversity and ecological processes affect human health. We will view humans as an integral but unique members of ecosystems whose well-being depends on a range of complex ecological services. Topics will include human-induced environmental changes, species invasions, species interactions, medicines from nature, and infectious diseases. The lab will involve conducting research on native and introduced species of medical importance.

ENST 450 Wetland Ecology (3 credits)
Prerequisite: BIOM301; or permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST450, NRMT450, or MEES650. Formerly: NRMT450.
Plant and animal communities, biogeochemistry, and ecosystem properties of wetland systems. Laboratory emphasizes collection and analysis of field data on wetland vegetation, soil, and hydrology.

ENST 451 Water Quality: Field and Lab Analysis Methods (3 credits)
Prerequisite: CHEM131 and CHEM132. And CHEM104; or (CHEM231 and CHEM232). Credit only granted for: ENBE451, ENST451, or NRMT451. Formerly: NRMT451.
Hands-on experience with techniques for assessing physical, chemical, and biological characteristics of surface waters, including streams, lakes, and wetlands. Emphasis is placed on understanding effects of water quality on ecosystem structure and function.

ENST 452 Wetland Restoration (3 credits)
Prerequisite: BSCI106; and (BSCI362, ENST450, ENST360, or BSCI361). Or permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST452, ENST652, or MEES652.
Design, construction, and evaluation of wetlands restored or created to provide ecosystem services or to mitigate losses due to development. Topics include fundamental properties of wetlands, ecological restoration theory, site selection and goal-setting, design plans, practices for establishing wetland hydrology, substrate, and vegetation, and restored ecosystem monitoring. Two mandatory Saturday field trips will be held (dates to be announced); waterproof boots or waders are recommended for field trips.

ENST 453 Watershed Science: Water Balance, Open Channel Flow, and Near Surface Hydrology (3 credits)
Credit only granted for: ENST453 or ENST653.
Concepts of surface water balance, surface radiative flux, precipitation and evaporation measurements.

ENST 460 Principles of Wildlife Management (3 credits)
Prerequisite: Must have completed two semesters of biology laboratory; and (ENST360; or BSCI361). Or permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST460 or NRMT460. Formerly: NRMT460.
Ecological principles and requirements of wildlife as basis for management, and introduction to the scientific literature. Conflicts in wildlife management, government administration of wildlife resources, legislation, and history of the wildlife management profession.

ENST 461 Urban Wildlife Management (3 credits)
Credit only granted for: ENST461 or NRMT461. Formerly: NRMT461.
Ecology and management of wildlife in urban areas. For students in biological sciences, geography, landscape design, natural resources management, recreation and urban studies. Planning, design, and wildlife conservation in landscape ecology. Public attitudes, preferences, and values, review of private conservation organizations.

ENST 462 Field Techniques in Wildlife Management (2 credits)
Prerequisite: ENST460; and BSCI105; and BSCI106. Recommended: ENST461. Restriction: Permission of AGNR-College of Agriculture & Natural Resources. Credit only granted for: ENST462, NRMT462, or NRMT489B. Formerly: NRMT462.
Hands-on experience with field techniques in wildlife management focusing on various methods of conducting indices, estimates, and censuses of wildlife populations. Includes capture and handling of amphibians, reptiles, birds, and mammals by use of drift fences, cover boards, mist nets, box traps, and dart guns.

ENST 463 Wildlife Habitat and Population Modeling (3 credits)
Prerequisite: ENST460, GEOG373, and MATH220; or permission of AGNR-Environmental Science & Technology department. Restriction: Must be in Environmental Sci & Tech program; and must be in Environmental Science and Policy program.
Students will gain basic tools for the analysis and modeling of wildlife population demographics and wildlife habitat. This class will be broken into two components: 1) will teach students techniques of modeling wildlife field data for the purpose of estimation of key parameters such as population size, viability, and other demographic rates using programs such as Riskman, Vortex, and Mark; 2) will teach students real world techniques used to determine and model habitat use on multiple scales using statistical analyses, GIS, and stand-alone programs such as Home Ranger and Biomapper. This class is designed for wildlife and natural resources majors.

ENST 466 Ecology and Management of Wildlife Habitats (3 credits)
Recommended: ENST460.
Introduction to general concepts of wildlife habitat ecology and management. Specifically,land use practices on public and private lands and how these practices influence wildlife production. Conduct wildlife habitat evaluations and options for alterations/manipulations to achieve specific management goals. The class will culminate with the creation and planning of a wildlife management plan.

ENST 467 Ecology and Management of Wildlife Habitats Lab (1 credits)
Corequisite: ENST466.
An introduction to the principles of wildlife habitat data analysis applied at the population level. This class will teach students real world techniques used to determine and model habitat use on multiple scales. This lab course complements the material covered in ENST 466.

ENST 471 Capstone I (2 credits)
This course will be conducted in a group discussion format that will focus on professional project proposal preparation and presentation, critical evaluation of environmental science research, professional development, and career planning. Students will develop and present original project proposals and critique project proposals presented by others.

ENST 472 Capstone II (3 credits)
Prerequisite: ENST471. Restriction: Must be in a major within AGNR-Environmental Science & Technology department; and permission of AGNR-Environmental Science & Technology department.
This course is the second in a two-part series. Students will continue work on projects proposed and begun in ENST471. Focus on professional project preparation, presentation, critical evaluation on environmental science research, professional development, and career planning. Students will develop and present original projects and critique projects presented by others.

ENST 477 Design for Urban Water and Energy (3 credits)
Prerequisite: BSCI361 or ENST360. And MATH221; or students who have taken courses with comparable content may contact the department. And PHYS121. Restriction: Junior standing or higher; and must be in a major within the AGNR-Environmental Science & Technology department. Credit only granted for: ENST489W or ENST477. Formerly: ENST4898W.
Sustainability of energy and water in urban watersheds. Principles of energy and water dynamics in the urban environment. Role of natural and artificial ecosystems in improving water quality, naturalizing hydrology, supporting ecological habitat and mitigating urban heat island. Ecological designs for minimizing use of energy and water in urban environments and sustainability evaluation techniques are discussed.

ENST 479 Tropical Ecology and Resource Management (1-6 credits)
Prerequisite: BSCI106; and must have completed an introductory economics course. Restriction: Permission of instructor. Repeatable to 10 credits if content differs. Formerly: NRMT479.
Tropical ecosystems and issues of human use and impact. Includes lectures which lead up to an off-campus trip in a tropical environment.

ENST 481 Ecological Design (3 credits)
Prerequisite: MATH220 or MATH140; and (PHYS121 and CHEM131); and (BSCI361; or students who have taken courses with comparable content may contact the department). Or permission of instructor. Restriction: Permission of AGNR-Environmental Science & Technology department. Also offered as: ENST681, MEES681. Credit only granted for: ENST481, ENST681, or MEES681.
An advanced survey course on the field of ecological design. Principles of design are illustrated with case studies from biologically-based waste treatment systems, ecosystem management and sustainable development. Concepts covered include ecology, ecological engineering, nutrient cycling, emergy, lifecycle analysis, and design process. Technologies include treatment wetlands, living machines, anaerobic digestion, rain gardens, bioswales, bioremediation, algal turf scrubbers, and green building design.

ENST 489 Field Experience (1-4 credits)
Restriction: Permission of AGNR-Environmental Science & Technology department. Repeatable to 6 credits. Formerly: NRMT489.
Planned field experience for both major and non-major students.

ENST 499 Special Topics in Environmental Science and Technology (1-4 credits)
Restriction: Permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST499, NRMT499, or NRSC499. Formerly: NRSC499 and NRMT499.
An independent study, and/or lecture, and/or laboratory series organized to study a selected phase of Environmental Science and Technology not covered by existing courses. Credit arranged with supervising faculty member.

ENST 602 Research Principles and Methodology in Environmental Scienceand Technolgy (3 credits)
Restriction: Must be in Environmental Sci & Tech program.
Fundamental research strategies and methods of investigation in Environmental Science and Technology including field and laboratory procedures.

ENST 604 Advanced Natural Resource and Environmental Ethics (3 credits)
Prerequisite: ENST214 and ENST360. Recommended: ENST314, ENST410, and ENST460. Also offered as: ENST404. Credit only granted for: ENST404 or ENST604. Additional information: This graduate level crosslist will provide an opportunity for graduate students to discuss advanced theories related to ecological ethics in practice. Students will build on the materials of ENST 404 with additional assignments and scheduled discussion.
Bridges science and management with ethical theory and concepts to help scientists, regulators, and managers understand how to deal with potential ethical dilemmas that arise in natural resource and environmental management implementation and policy development.

ENST 605 Energy and Environment (3 credits)
Prerequisite: MATH220; or students who have taken courses with comparable content may contact the department. Also offered as: ENST405. Credit only granted for: ENST405, ENST605, NRMT489Z, or MEES698Z.

Formerly: MEES698Z.
Role of energy in environmental and human-dominated systems and their linkage. Discussion of the historical and modern production and consumption of energy. Energy systems simulation modeling, energy analysis and energy auditing. Review of national energy policies and proposed alternatives.

ENST 608 Research Methods (1-4 credits)
Restriction: Permission of AGNR-Environmental Science & Technology department. Repeatable to 4 credits if content differs. Credit only granted for: ENST608 or NRSC608. Formerly: NRSC608.
Development of research viewpoint by detailed study and report on crop and soil research of the Maryland Agriculture Experiment Station or review and discussion of literature on specific agricultural problems or new research techniques.

ENST 611 Advanced Principles of Soil Fertility (3 credits)
Prerequisite: ENST200; or students who have taken courses with comparable content may contact the department. Also offered as: ENST411. Credit only granted for: ENST411, NRSC411, or ENST611.
Soil factors affecting plant growth and quality with emphasis on the bio-availability of mineral nutrients. The management of soil systems to enhance plant growth by means of crop rotations, microbial activities, and use of organic and inorganic amendments.

ENST 622 Advanced Soil Microbial Ecology (3 credits)
Prerequisite: ENST200; or 1 course in BCHM; or must have completed one course in microbiology; or students who have taken courses with comparable content may contact the department. Also offered as: ENST422. Credit only granted for: ENST422 or ENST622.
The interdisciplinary study of soil microorganisms and their interactions with the mineral matrix; resulting in processes such as nutrient cycling, decontamination, and natural product production. We will focus on the diversity of soil communities, their survival strategies, and the new strategies used to study these communities.The course will include an examination of current literature in this field.

ENST 630 Advanced Wetland Soils (3 credits)
Prerequisite: ENST200. Credit only granted for: ENST630, ENST403, or NRSC461.
The soils of wetlands including hydrology, biogeochemistry, and pedogenesis, including a focused discussion of current literature. Federal and regional guidelines for wetland soils are covered with an emphasis on validating interpretations through field observations.

ENST 640 Advanced Crops, Soils, and Civilization (3 credits)
Also offered as: ENST440. Credit only granted for: ENST440 or ENST640.
Explore the rise, cycling, resilience, and decline of civilizations and apply learning to modern issues in the fields of sustainability, environmental ethics, natural resource management, and agriculture. Role and importance of crop and soil resources in the development of human civilization. History of crop and soil use and management as they relate to the persistence of ancient and modern cultures.

ENST 643 Advanced Industrial Ecology (3 credits)
Prerequisite: BSCI361; and permission of AGNR-Environmental Science & Technology department. Also offered as: ENST443. Credit only granted for: ENST443 or ENST643.
Problems of waste management and recycling in human societies are covered. The industrial ecology approach to design is contrasted with analogous patterns and processes from natural ecosystems.

ENST 647 Advanced Biodiversity, Ecology, and Human Health (3 credits)
Prerequisite: BSCI361; or permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST447, ENST647, or MEES647.
An investigation of how biodiversity and ecological processes affect human health. Humans as integral but unique members of ecosystems whose well-being depends on a range of complex ecological services will be viewed. Topics will include human-induced environmental changes, species invasions, species interactions, medicines from nature, and infectious diseases. Students will lead class discussion of peer-reviewed literature and complete an assignment writing a research grant proposal. The lab will involve researching native and introduced species of medical importance.

ENST 650 Advanced Wetland Ecology (3 credits)
Prerequisite: BIOM301; or permission of AGNR-Environmental Science & Technology department. Also offered as: MEES650. Credit only granted for: ENST450, ENST650, or MEES650.
Plant and animal communities, biogeochemistry, and ecosystem properties of wetland systems. Laboratory emphasizes collection and analysis of field data on wetland vegetation, soil, and hydrology.

ENST 652 Advanced Wetland Creation and Restoration (3 credits)
Prerequisite: BSCI106. And BSCI362, ENST450, or MEES650; or permission of AGNR-Environmental Science & Technology department. Also offered as: ENST452, MEES652. Credit only granted for: ENST452, ENST652 or MEES652. Additional information: Two mandatory Friday afternoon field trips will be held from 1:00 - 6:00; hip length wading boots are recommended for field trips.
Design, construction, and evaluation of wetlands restored or created for ecosystem enhancement or mitigation. Topics will include ecological restoration theory, goal-setting, practices for establishing wetland hydrology, substrate, and vegetation, and restored ecosystem monitoring and functional assessment.

ENST 681 Advanced Ecological Design (3 credits)
Prerequisite: Must have completed one semester of calculus; and (CHEM131 and PHYS121). Or permission of instructor. Also offered as: ENST481, MEES681. Credit only granted for: ENST481, ENST681, or MEES681.
An advanced survey course on the field of ecological design. Principles of design are illustrated with case studies from biologically-based waste treatment systems, ecosystem management and sustainable development.

ENST 689 Special Topics (1-3 credits)
Repeatable to 6 credits if content differs. Credit only granted for: ENST689 or NRSC689. Formerly: NRSC689.
Credit according to time scheduled and organization of the course. Organized as a lecture series on a specialized advanced topic.

ENST 702 Environmental Science and Technology: Communication and Professional Development (2 credits)
Prerequisite: ENST602. Restriction: Must be in Environmental Science and Technology (Master's) program; or must be in Environmental Science and Technology (Doctoral) program; or permission of instructor.
Training in communication and professional development to prepare students to succeed in careers within the fields of environmental science and technology. Topics will include manuscript and technical writing, job search, communication with academic and non-academic audiences, multi-disciplinary collaboration, management (project, personnel, time), professionalism, leadership, ethics, and career opportunities. Course emphasizes

practical training through facilitated discussions and critique practicums.

ENST 722 Advanced Soil Chemistry (3 credits)

Restriction: Permission of instructor; and permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST722 or NRSC722. Formerly: NRSC722.

A continuation of AGRO 421 with emphasis on soil chemistry of minor elements necessary for plant growth.

ENST 761 Methods in Pedological Investigations (4 credits)

Prerequisite: ENST414; or permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST761 or NRSC761. Formerly: NRSC761.

This is designed to equip students with analytical tools for soil microfabric and mineralogical analysis in order to understand soil properties and processes. A number of techniques will be discussed, but emphasis will be placed on micromorphology and x-ray diffractometry. Both theoretical and applied considerations will be convered, and students will gain substantial hands on experience in collecting and interpreting data germane to their research interests.

ENST 789 Advances in Research (1-4 credits)

Repeatable to 4 credits if content differs. Credit only granted for: ENST789 or NRSC789. Formerly: NRSC789.

A study of recent advances in agronomy research.

ENST 798 Graduate Seminar (1 credits)

Restriction: Must be in one of the following programs (Environmental Science and Technology (Doctoral); Environmental Science and Technology (Master's)) ; or permission of AGNR-Environmental Science & Technology department. Repeatable to 6 credits. Credit only granted for: ENST798 or NRSC798.

Designed to provide a venue for interactive discussion between ENST graduate students and other members of the ENST community regarding thesis/dissertation research planned or conducted as part of the students graduate program.

ENST 799 Master's Thesis Research (1-6 credits)

ENST 821 Advanced Methods of Soil Investigation (3 credits)

Credit only granted for: ENST821 or NRSC821. Formerly: NRSC821.

First semester, alternate years. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry.

ENST 831 Soil Mineralogy (4 credits)

Soil minerals, with emphasis on clay minerals, are studied from the viewpoint of soil genesis and physical chemistry. Mineralogical analyses by x-ray and chemical techniques.

ENST 832 Advanced Soil Physics (3 credits)

Restriction: Permission of instructor; and permission of AGNR-Environmental Science & Technology department. Credit only granted for: ENST832 or NRSC832. Formerly: NRSC832.

An advanced study of physical properties of soils.

ENST 898 Pre-Candidacy Research (1-8 credits)

ENST 899 Doctoral Dissertation Research (1-8 credits)

Entomology (ENTM)

ENTM 609 Integrated Pest Management (1-4 credits)

Restriction: Permission of instructor. Repeatable to 10 credits if content differs. Also offered as: NRSC609. Credit only granted for: ENTM609 or NRSC609.

A modular course with an interdisciplinary approach to the theory and practice of integrated pest management. Topics of modules, each 3-4 weeks long, vary each semester over a three year time frame, with the first module serving as a prerequisite for all other modules.

ENTM 612 Insect Ecology (3 credits)

Prerequisite: Permission of CMNS-Entomology department; or must have completed a course in general ecology.

An advanced course in population and community ecology, plant-insect interactions, and insect biogeography. Emphasis on current entomological literature.

ENTM 622 Principles of Systematic Entomology (3 credits)

The principles of systematics including traditional classification methods, cladistics, and numerical taxonomy. Nomenclature, continental drift, and speciation theory. A laboratory problem in systematics is required.

ENTM 623 Insect Population Genetics (3 credits)

Forces that alter allele and genotype frequencies, population structure, population genetic analysis of molecular data, quantitative genetics, and the implications for biodiversity and pest management.

ENTM 667 Aquatic Entomology (3 credits)

Biology, ecology, and taxonomy of aquatic insects in lotic and lentic habitats, their adaptation to aquatic life, their function in aquatic ecosystems, and their relationship to environmental deterioration.

ENTM 699 Advanced Entomology (1-6 credits)

Credit and prerequisites to be determined by the department. First and second semesters. Studies of minor problems in morphology, physiology, taxonomy and applied entomology, with particular reference to the preparation of the student for individual research.

ENTM 701 Effective Teaching: TA Training (1 credits)

A survey and discussion of topics pertinent to graduate students who are first-time teaching assistants, including teaching responsibilities and policies, effective techniques of lecturing and leading discussions, composing and grading quizzes and exams, cultural diversity, time management, and development of a teaching portfolio. All teaching assistants in the College of Life Sciences must take a 701 TA training course in one of the departments.

ENTM 788 Entomological Topics (1-3 credits)

Prerequisite: Permission of CMNS-Entomology department.

One lecture or one two-hour laboratory period a week for each credit hour. Lectures, group discussions or laboratory sessions on selected topics such as: aquatic insects, biological control of insects, entomological literature, forest entomology, history of entomology, insect biochemistry, insect embryology, immature insects, insect behavior, insect communication, principles of entomological research.

ENTM 789 Field Experience in Pest Management (1-6 credits)

Repeatable to 6 credits.

Involvement in practical problems of pest management in field situations. The student will be assigned to a problem area for intensive experience, usually during the summer. A final written report is required for each assignment.

ENTM 798 Topic Seminar (1 credits)
Prerequisite: Permission of CMNS-Entomology department.
Discussion and presentation of current research and literature.

ENTM 799 Master's Thesis Research (1-6 credits)

ENTM 898 Pre-Candidacy Research (1-8 credits)

ENTM 899 Doctoral Dissertation Research (1-8 credits)

Telecommunications (ENTS)

ENTS 609 Telecommunications Project (3 credits)
Consists of a student project in the area of telecommunication system applications, management, or policy. Specific projects will be supervised individually by faculty members associated with the M.S Program in Telecommunications.

ENTS 622 Introduction to Digital Communication Systems (3 credits)
Restriction: Must be in Telecommunications (Master's) program; or permission of ENGR-Electrical & Computer Engineering department. Credit only granted for: ENTS622 or ENTS689B. Formerly: ENTS689B.
Principles of analog and digital communication systems design. Analysis of the performance and relative merits of different modulation and demodulation, signal processing, filtering and error control schemes in communication systems. Also provides an understanding of the design of modern digital communication systems.

ENTS 625 Management and Organizational Behavior in the Telecommunications Industry (3 credits)
Roles of the general manager in: determining target markets and designing strategies for them; formulating and implementing corporate and business level strategies; and staffing, developing, and managing human resources and coordinating them with the organization's financial and physical resources. Also emphasizes the building of interpersonal skills with respect to the selection of members for work teams and team formation, leadership of teams toward the achievement of strategic goals and total quality, the development and motivation of team members, and the evaluation of team and individual performance.

ENTS 629 Special Topics in Cybersecurity (3 credits)
Restriction: Must be in Telecommunications (Master's) program. Repeatable to 18 credits if content differs.
Selected topics of current importance in cybersecurity.

ENTS 630 The Economics of International Telecommunications (3 credits)
Restriction: Must be in Telecommunications (Master's) program.
Basic microeconomic principles used by telecommunications firms, including supply and demand, elasticity, costs, productivity, pricing, market structure and competitive implications of alternative market structures. Market failures and government intervention. Public policy processes affecting business operations.

ENTS 632 Telecommunications Marketing Management (3 credits)
Restriction: Must be in Telecommunications (Master's) program.
Topics covered include strategic marketing, sales and customer service challenges confronting organizations in the computer, communications and media industries. The course also addresses volatile technology, regulatory and competitive environments as a backdrop to strategic planning and management in the marketing domain.

ENTS 635 Decision Support Methods for Telecommunication Managers (3 credits)
Restriction: Must be in Telecommunications (Master's) program.
The aim of this course is to introduce management science techniques for informed decision making. Topics covered can include data analysis and regression, optimization models and applications (workforce scheduling, manufacturing, network design, facility location), sensitivity analysis, decision trees, risk analysis and business simulation models. Emphasis will be on telecommunications managerial problems, model development and the use of software packages for decision support.

ENTS 639 Special Topics in Business (3 credits)
Restriction: Must be in Telecommunications (Master's) program. Repeatable to 18 credits if content differs.
Selected topics of current importance in business.

ENTS 640 Networks and Protocols I (3 credits)
Restriction: Must be in Telecommunications (Master's) program.
An overview of design issues and the important industry standards for digital communications networks. This includes protocols, data communications technologies, error correction and detection, congestion control, traffic routing, Local Area Network (LAN) protocols, TCP/IP, and some security issues.

ENTS 641 Networks and Protocols II (3 credits)
Prerequisite: ENTS640. Restriction: Must be in Telecommunications (Master's) program.
Techniques for the specification, design, analysis, verification and testing of communication protocols are discussed. The course includes detailed discussion on routing protocols in the Internet. This includes Routing Information Protocol (RIP), Enchanced Interior Gateway Routing Protocol (EIGRP). Open Shortest Path First (OSPF), and Border Gateway Protocol (BGP4).

ENTS 649 Special Topics in Networking (3 credits)
Restriction: Must be in Telecommunications (Master's) program.
Selected topics of current importance in networking.

ENTS 650 Network Security (3 credits)
Prerequisite: ENTS640. Restriction: Must be in Telecommunications (Master's) program.
Various approaches to design, specification, and verification of security protocols used in large systems and networks. Topics of network security, security threats and countermeasures, communication security and basic encryption techniques, data confidentiality and integrity, analysis of cryptographic protocols, and access control in large systems and networks.

ENTS 653 AWS/PCS System Implementation (3 credits)
Restriction: Must be in Telecommunications (Master's) program. Credit only granted for: ENTS653 or ENTS689A. Formerly: ENTS689A.
Engineering issues associated with designing and deploying a AWS/PCS cellular wireless communications system in the current world environment will be examined. The course will focus on implementation issues such as the impact of real world concerns on the deployment strategy and the use of good engineering practice to overcome obstacles. Students will create and modify mock deployments using professional tools for cell planning and interference analysis. Students will also be exposed to drive testing tools and

concepts for migration to future technologies.

ENTS 654 Optimization and Analysis of GSM Networks (3 credits)

Prerequisite: ENTS656 or ENTS653; and permission of ENGR-Electrical & Computer Engineering department. Restriction: Must be in Telecommunications (Master's) program. Credit only granted for: ENTS654 or ENTS689B.

The techniques needed to successfully optimize a functioning GSM networkwill be examined. Students will conduct extensive drive tests of a working network in the Washington DC area using state-of-the-art drive test equipment and will analyze the recorded data with post-processing analysis tools. Also, they will learn to recognize problems based on network behaviors and what courses of action are available to correct them. Lab work and data collection will constitute a majority of the class work.

ENTS 656 Introduction to Cellular Communication Networks (3 credits)

Concepts and techniques involved in wireless digital communications with emphasis on cellular and PCS systems. Properties of Mobile radio channels; intersymbol interference, multipath, and fading effects; interleaving and diversity; multiple access schemes (TDMA, FDMA, CDMA); interuser interference, traffic issues, and cell capacity; power control strategies; frequency reuse and channel assignment; handoff, paging, and location update; cell layout; introduction to cellular and PCS standards.

ENTS 657 Satellite Communication Systems (3 credits)

Credit only granted for: ENTS657 or ENTS689S. Formerly: ENTS689S.

An examination of satellite telecommunication systems with an emphasis on the mobile satellite systems (MSS). Topics will include a historical perspective, orbital mechanics and constellations, choice of orbital parameters, propagations considerations, link budgets, interference issues and other obstacles, and existing and proposed mobile satellite systems. It will also look at some of the business aspects such as the cost of deploying and maintaining these systems.

ENTS 659 Special Topics in Communications (3 credits)

Restriction: Must be in Telecommunications (Master's) program.

Selected topics of current importance in communications.

ENTS 665 Advanced Wireless Communications Networks (3 credits)

Prerequisite: ENTS622; or students who have taken courses with comparable content may contact the department. And (ENTS656 or ENTS653). Restriction: Must be in Telecommunications (Master's) program. Credit only granted for: ENTS689E or ENTS665.

This course presents the key concepts and principles used in the design of Third and Fourth Generation of wireless access technologies, i.e. 3G and 4G systems and networks. In addition to generic technology concepts the course also provides students with system level overviews of such key radio access systems from both radio interface and network architecture perspectives as well as deployment, evolution and service planning issues. More specifically PHY and MAC/signaling layer design of 3GPP2 technologies like CDMA 2000 and EV-DO as well as 3GPP standards such as WCDMA and HSPA will be the focus of this course. The course concludes with a technical introduction to OFDMA based 4G systems such as WiMAX and LTE and their deployment plans.

ENTS 670 Introduction to Business and Enterpreneurship (3 credits)

Restriction: Must be in Telecommunications (Master's) program. Credit only granted for: ENTS670 or ENTS689J.

This is a fundamental course that provides a broad introduction to various business issues faced by any small business or starup. Course instructors present the key issues involved in outlining a clear value proposition and profitable business model, managing and monitoring finances, developing a winning team, addressing legal considerations, executing on operations including marketing sales, manufacturing and service.

ENTS 672 Global Economic Environment (3 credits)

Restriction: Must be in Telecommunications (Master's) program. Credit only granted for: ENTS672 or ENTS689O. Formerly: ENTS689O.

This course is intended to provide the future manager, particularly in the telecommunications industry, with the tools necessary to intelligently interpret the national and international economic environment including the impact of economic policies on the economy and the firm. It develops basic macroeconomic theory to enable managers to critically evaluate economic forecasts and policy recommendations, and then applies these concepts in a searies of case studies.

ENTS 673 Project Management for Telecommunications (3 credits)

Formerly: ENTS689P.

Introduces modiern project management. Begins with an overview and expands into Adaptive and Extreme project management. The focus then shifts to the individual skills required to be an effective project manager, such as time management, leadership and motivation. Once skills of the individual have been addressed, social networks and how they impact project management are examined.

ENTS 689 Special Topics in Telecommunications (3 credits)

Restriction: Must be in Telecommunications (Master's) program. Repeatable to 18 credits if content differs.

Selected topics of current importance in telecommunications.

ENTS 699 Independent Study in Telecommunications (1-3 credits)

Repeatable to 3 credits if content differs.

Individual instruction course. See ENTS program office for section number.

ENTS 749 Advanced Topics in Networking (3 credits)

Prerequisite: ENTS640 or ENTS641; or permission of instructor. Restriction: Must be in Telecommunications (Master's) program. Repeatable to 18 credits if content differs.

Selected advanced topics in networking.

ENTS 759 Advanced Topics in Communications (3 credits)

Prerequisite: ENTS622; or students who have taken courses with comparable content may contact the department. And (ENTS656 or ENTS653). Restriction: Must be in Telecommunications (Master's) program. Repeatable to 18 credits if content differs.

Selected advanced topics in communications.

Epidemiology and Biostatistics (EPIB)

EPIB 610 Foundations of Epidemiology (3 credits)

Prerequisite: EPIB300; or equivalent undergraduate statistics or biostatistics course with a grade of C- or higher; or a score of 70% or higher on EPIB300 placement exam. Credit only granted for: EPIB610 or HLTH720. Formerly: HLTH720.

Introduction to the discipline of epidemiology and its applications to health issues and practices. Basic epidemiologic concepts and methods will be covered.

EPIB 611 Intermediate Epidemiology (3 credits)
Prerequisite: EPIB610.
Analysis of epidemiologic methods as applied to epidemiologic research, analysis of bias, confounding, effect modification issues, overview of design, implementation, and analysis of epidemiologic studies.

EPIB 612 Epidemiologic Study Design (3 credits)
Prerequisite: EPIB650, EPIB610, and EPIB611.
Application of epidemiologic study designs, analytic methods used for analysis of cohort, case-control, cross-sectional, and clinical trials research.

EPIB 620 Chronic Disease Epidemiology (3 credits)
Prerequisite: EPIB610.
Overview of prevalence and risk factors for major chronic diseases. Discussion of methodological issues unique to specific chronic disease.

EPIB 621 Infectious Disease Epidemiology (3 credits)
Prerequisite: EPIB610.
Overview of the unique aspects of infectious diseases and the epidemiological methods used in their study, prevention, and control.

EPIB 622 Social Determinants of Health (3 credits)
Prerequisite: EPIB610.
Overview of the major social variables that affect public health, including socioeconomic status, poverty, income distribution, race, social networks/support, community cohesion, psychological stress, gender, and work and neighborhood environment.

EPIB 623 Epidemiology of Health Disparities (3 credits)
Prerequisite: EPIB610.
Determinants that influence health outcomes of the most disadvantaged populations in the United States. Focus on social factors contributing to health disparities and inequities in the US.

EPIB 624 Genetic in Public Health (3 credits)
Prerequisite: EPIB610.
Emerging role of genetics in public health; overview of basic tenets of human genetics; examination of how public health practices and research are influenced by genetics and ethical issues specific to genetics.

EPIB 625 Epidemiology of Physical Activity (3 credits)
Prerequisite: EPIB610.
Overview of evidence of the epidemiological association of physical activity to a variety of health outcomes, application of epidemiological methods to the science of physical activity and health.

EPIB 626 Epidemiology of Obesity (3 credits)
Prerequisite: EPIB610.
Overview of the epidemiological, prevention, and treatment of obesity, its causes and consequences, and energy balance issues; application of epidemiologic methods to the study of obesity epidemiology.

EPIB 641 Public Health and Research Ethics (1 credits)
Overview and discussion of ethical issues that face public health practitioners and researchers.

EPIB 650 Biostatistics I (3 credits)
Prerequisite: EPIB300; or equivalent undergraduate statistics or biostatistics course with a grade of C- or higher; or a score of 70% or higher on EPIB placement exam. Credit only granted for: EPIB650, HLTH651, or HLTH688B. Formerly: HLTH651 and HLTH688B.
Basic statistical concepts and procedures for Public Health. Focuses on applications, hands-on-experience, and interpretations of statistical findings.

EPIB 651 Biostatistics II (3 credits)
Prerequisite: EPIB650. Recommended: EPIB698C (SAS Basics).
Introduction to a variety of statistical tools with applictions in public health, including one- and two-sample inference, nonparametric methods, categorical data, ANOVA, simple and mutiple regression.

EPIB 652 Categorical Data Analysis (3 credits)
Prerequisite: EPIB650 and EPIB651. Recommended: EPIB698C (SAS Basics).
Methods for analysis of categorical data as applied to public health research, including contingency tables, logistic regression, multicategory logic models, loglinear models, and models for matched-pairs.

EPIB 653 Applied Survival Data Analysis (3 credits)
Prerequisite: EPIB650 and EPIB651.
Overview of statistical methods for anlayzing censored survival data, including the Kaplan-Meier estimator, the log-rank test, Cox PH model.

EPIB 654 Clinical Trial Analysis (3 credits)
Prerequisite: EPIB650 and EPIB651.
Principles of clinical trial design, including randomization strategies, design and analytic issues to minimize threats to validity, sample size and power calculations, intention to treat analyses.

EPIB 655 Longitudinal Data Analysis (3 credits)
Prerequisite: EPIB650 and EPIB651.
Statistical models for drawing scientific inferences from longitudinal data, longitudinal study design, repeated measures and random effects to account for experimental designs that involve correlated responses, handling of missing data.

EPIB 657 Spatial Statistics for Public Health Data (3 credits)
Prerequisite: EPIB651 and EPIB652; or permission of instructor.
Overview three main areas of spatial statistics: point patterns, geostatistical data, and lattice (areal) data. Application of spatial statistical models including CSR, k-function, krigging, semivariogram, CAR, SAR, GWR, spatial GLM, and multilevel model to public health and environmental data analysis.

EPIB 660 Epidemiologic Methods for Primary Research (3 credits)
Prerequisite: EPIB610; or permission of instructor.
Students are provided with the knowledge and skills needed to design and implement epidemiological research studies and to collect primary data. Presents an overview of types of research designs, sampling methodologies, measurement issues, questionnaire design, and guidelines for recruiting and interacting with participants. This foundation of knowledge is applied to group assignments, which apply the steps involved in the primary data collection process. Goals include: (a) achieving competence in designing and implementing studies based on scientifically sound epidemiological research methods; and (b) gaining the ability to critically evaluate health research and epidemiological studies.

EPIB 672 Public Health Informatics (3 credits)
Restriction: Instructor permission is required for students not enrolled in a degree seeking program in the School of Public Health. Also offered as: HLTH672. Credit only granted for: HLTH670 or HLTH672 or EPIB672. Formerly: HLTH670. Additional information: Course hashtag - #umdphi12.
A basic overview of Informatics and its application in a public health setting. The major goal is for students to understand the basic tools and building blocks needed to utilize this technology in order to improve their professional productivity

EPIB 698 Special Topics in Epidemiology and Biostatistics

(1-3 credits)
Open to master or doctoral students who desire to pursue special topics in Epidemiology and Biostatistics.

EPIB 710 Epidemiologic Research Methods (3 credits)
Prerequisite: EPIB650, EPIB610, EPIB612, EPIB651, and EPIB611.
In-depth study of the knowledge and skills needed to design, conduct, and evaluate an epidemiologic research study. Development of a complete research project.

EPIB 740 Advanced Methods in Epidemiology (3 credits)
Prerequisite: EPIB650, EPIB610, EPIB612, EPIB651, and EPIB611.
In-depth investigation of epidemiologic methods for making causal inferences and solving complex methodological problems. Multivariate models emphasized.

EPIB 785 Internship in Public Health (3 credits)
Prerequisite: Permission of SPHL-Epidemiology & Biostatistics department.
Internship and seminar providing an opportunity to apply previously acquired knowledge and skills in a health or allied health organization. Setting of the internship will depend upon the student's background and career goals.

EPIB 786 Capstone Project in Public Health (3 credits)
Prerequisite: Permission of SPHL-Epidemiology & Biostatistics department.
Capstone experience providing opportunity to apply knowledge and skills to a specific public health problem or issue. Completion of project relevant to public health under the direction of an advisor.

EPIB 788 Critical Readings in Epidemiology and Biostatistics (1-3 credits)
Prerequisite: Must have completed or be concurrently enrolled in EPIB610. Repeatable to 6 credits if content differs.
Open to master and doctoral students to discuss critical readings in Epidemiology and Biostatistics.

EPIB 798 Independent Study (1-6 credits)
Prerequisite: Permission of SPHL-Epidemiology & Biostatistics department. Repeatable to 9 credits if content differs.
Master or doctoral students who desire to pursue special research problems under the direction of a faculty memeber of the department may register for 1-6 hours of credit under this number.

EPIB 799 Master's Thesis Research (1-6 credits)

EPIB 898 Pre-Candidacy Research (1-8 credits)

EPIB 899 Doctoral Dissertation Research (1-8 credits)

Film Studies (FILM)

FILM 410 Documentary and Narrative (3 credits)
Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-College of Arts & Humanities.
Also offered as: SLLC410. Credit only granted for: SLLC410 or FILM410.
An examination of the relationship between film and reality, focusing on documentary film.

FILM 411 Experimental Film (3 credits)
Also offered as: SLLC411. Credit only granted for: SLLC411 or FILM411.
Introductory survey of European and U.S. American experimental cinema.

FILM 412 Animation and Cinema (3 credits)
Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-College of Arts & Humanities. Restriction: Must not have completed ENGL468C. Credit only granted for: FILM412 or ENGL468C.
An examination of animation in art, cinema, and other media.

FILM 419 Special Topics in Documentary, Animation, Experimental Cinema, and Other Media (3 credits)
Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; and or permission of ARHU College of Arts and Humanities. Restriction: Varies depending on the crosslist. Repeatable to 6 credits if content differs.
Advanced studies in Documentary, Animation, Experimental Cinema, and Other Media. Examines the possibilities of non-narrative cinema, or cinema that is structured differently from the fiction feature film, as well as other media (television, digital imagery, and photography) that entertain a close relationship with cinema in terms of form, content, and audience. Content varies.

FILM 420 French Cinema: A Cultural Approach (in Translation) (3 credits)
Also offered as: FREN480. Credit only granted for: FREN480 or FILM420.
A study of French culture, civilization, and literature through the medium of film. Taught in English.

FILM 421 Francophone African Film (3 credits)
Also offered as: FREN421. Credit only granted for: FREN421 or FILM421.
Imaginary and Memory in the Reality of Francophone African Film from 1960-present. Taught in English.

FILM 423 Women and French Cinema (3 credits)
Also offered as: FREN423. Credit only granted for: FREN423 or FILM423.
Cultural identity, social boundaries and gender roles in French film as well as introduction to film textual analysis and diverse film theories (semiotics, film and psychoanalysis, feminist film theory, structuralism, narratology, spectatorship and cultural studies). Taught in French.

FILM 426 Modern Chinese Film and Visual Culture (3 credits)
Also offered as: ARTH484. Credit only granted for: FILM426 or ARTH484; ARTH489F in F2012, F2011, F2008, or S2009; or ARTH488F in S2010, S2008, or F2009. Formerly: ARTH489F in F2012, F2011, F2008, or S2009; or ARTH488F in S2010, S2008, or F2009.
Modern Chinese culture, society, and history studied through examples of art, film, and visual culture.

FILM 427 Visions and Fictions from Spain (3 credits)
Prerequisite: SPAN331, SPAN332, or SPAN333; or students who have taken courses with comparable content may contact the department; or permission of ARHU-Spanish & Portuguese Languages & Literatures department.
Also offered as: SPAN427. Credit only granted for: FILM427 or SPAN427.
Overview of Spanish Cinema from the end of the 19th century through present day Spain. Exploration of the production of literary and cinematic texts in their sociohistorical, political, religious and cultural contexts. Taught in Spanish.

FILM 429 Special Topics in National/International Cinemas (3 credits)
Repeatable to 6 credits.
Courses in National/International Cinemas may examine one or more national cinematic traditions (including Hollywood cinema), or may look across traditions comparatively, for example at international and/or transnational phenomena. Content varies.

FILM 430 Critical Issues in Israeli Cinema (3 credits)
Also offered as: HEBR430. Credit only granted for: HEBR430 or FILM430.

Critical investigation of Zionist and Israeli culture and politics through film.

FILM 431 Italian Cinema II - In Translation (3 credits)

Also offered as: ITAL473. Credit only granted for: ITAL473, ITAL474, or FILM431.

A study of Italian society and culture through the medium of film from the mid 1970's to the present. Taught in English.

FILM 433 Holocaust in Italian Literature and Cinema (3 credits)

Also offered as: ITAL433. Credit only granted for: ITAL433, or FILM433.

Review of literature and theoretical writings of Italy's most famous survivor, Primo Levi, to a sampling of Italian films that focus in vastly different and often extremely controversial ways on the experience of the concentration camp, while addressing a series of central questions from the brutal realities of the camps to the "compromises" made in order to survive, the need to bear witness, and the idea of the survivor's guilt.

FILM 441 Italian Cinema I: Neorealism (3 credits)

Also offered as: ITAL436. Credit only granted for: FILM441 or ITAL436.

Explores representations of Italy in cinema with special focus on identity formation and the movement of Italian neorealism and post neorealism. Taught in English.

FILM 451 Film Noir and American Culture (3 credits)

Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-College of Arts & Humanities. Restriction: Must not have completed ENGL428A (Summer 2006, Spring 2007, Summer 2009) or ENGL379Q (Fall 2009) or HHUM106 (Spring 2012), or ARTH389A (Spring 2012). Credit only granted for: FILM451, ENGL468D, ENGL428A ,ENGL379Q, HHUM106, or ARTH389A (Spring 2012). Formerly: ENGL428A and ENGL379Q.

Introduction to a variety of American movies made in the 1940s and 1950s whose dark themes and stark black-and-white lighting led to their identification as film noir.

FILM 452 The Origins of Cinema (3 credits)

Prerequisite: ENGL245, FILM245, FILM283, or SLLC283; or permission of Film Studies Program. Credit only granted for: FILM452 or ENGL468G.

An in-depth engagement with the specificity of early cinema, dedicated to a comparative framework that compares the early cinema period (1890-1915) to other moments of media emergence, both before and after cinema, with special emphasis on the current, "digital" moment.

FILM 461 Political Cinema (3 credits)

Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-College of Arts & Humanities. Also offered as: SLLC461. Credit only granted for: SLLC461, FILM461, SLLC468P, or CMLT498P. Formerly: SllC468P and CMLT498P.

Histories of cinemaa and politics in the 20th century.

FILM 463 Screening Time: History and Memory in Cinema (3 credits)

Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-College of Arts & Humanities. Also offered as: SLLC463. Credit only granted for: SLLC463 or FILM463.

An examination of the ways and techniques with which cinema produces a sense of time in the viewer.

FILM 499 Directed Study in Film Studies (1-3 credits)

Prerequisite: Permission of instructor. Repeatable to 9 credits if content differs.

Readings and Research in Film Studies under faculty supervison.

Family Science (FMSC)

FMSC 420 African American Families (3 credits)

Recommended: FMSC330. Credit only granted for: FMSC420 or FMSC498F. Formerly: FMSC498F.

Examination of the history, structure, cultural foundation, and diversity of African American family life is the focus of this class. Presentations and discussions enable students to identify, analyze, and assess: (1) the major theoretical perspectives used in the study of African American families; (2) the impact of social policy on African American families; and (3) specific areas of family life (e.g., marriage and divorce, parenting, child development, health disparities).

FMSC 425 Military and Veteran Family Services (3 credits)

Recommended: Moderate level of computer literacy, especially Internet and ELMS. Reliable computer and Internet access. Credit only granted for: FMSC425 or FMSC498W. Formerly: FMSC498W.

Overview of issues impacting contemporary military families including during times of war. Identification of challenges faced by military families related to deployment/reunion and mental and physical health, as well as support systems available. Examination of skills and strategies for working with service members, veterans, and military families.

FMSC 430 Gender Issues in Families (3 credits)

Prerequisite: SOCY100, SOCY105, or PSYC100. Also offered as: WMST430. Credit only granted for: FMSC430, FMST430, or WMST430. Formerly: FMST430.

The development of historical, cultural, developmental, and psychosocial aspects of masculinity and femininity within the context of contemporary families and the implications for interpersonal relations.

FMSC 431 Family Crises and Intervention (3 credits)

Prerequisite: PSYC100. Credit only granted for: FMSC431 or FMST431. Formerly: FMST431.

Family crises such as divorce, disability, substance abuse, financial problems, intra-familial abuse, and death. Theories and techniques for intervention and enhancement of family coping strategies.

FMSC 432 Adult Development and Aging in Families (3 credits)

Prerequisite: PSYC100; and (SOCY100 or SOCY105). And FMSC332; or must have completed a comparable development course. Restriction: Must be in a major within SPHL-Family Science department. Credit only granted for: FMSC432 or FMST432. Formerly: FMST432.

Theory, research, history, and programming related to adult development and aging in the intergenerational context of family.

FMSC 440 Death and Loss in Family Life (3 credits)

Recommended: Moderate level of computer literacy, especially Internet and ELMS. Reliable computer and Internet access. Credit only granted for: FMSC440 or FMSC498B. Formerly: FMSC498B.

Examination of how families experience grief and loss resulting from the death of a family member, including health and financial consequences. Overview of historical, social, psychological, cultural, medical, and legal dimensions of death in families from diverse backgrounds. Exploration of how the health care system and funeral home industry assist families in managing death and loss.

FMSC 445 Sexuality: Issues in Family Therapy and Service Delivery (3 credits)

Prerequisite: A basic course in human sexuality; and permission of instructor. Also offered as: FMSC645. Credit only granted for: FMSC445 or FMSC498T. Formerly: FMSC498T.

Typical, dysfunctional, and pathological sexual functioning, including effects on individuals, couples, and family systems. Sensitizes students to sexual issues, explores how perceptions of such issues

affect work with people, and emphasizes implications for marriage and family therapy.

FMSC 452 Family Policy Analysis (3 credits)
Prerequisite: Permission of SPHL-Family Science department. Credit only granted for: FMSC452 or FMST452. Formerly: FMST452.
Examination of public, private, and nonprofit sector policies and their impact on the quality of family life. Emphasis on policy formation, implementation, and evaluation.

FMSC 460 Violence in Families (3 credits)
Prerequisite: SOCY100, SOCY105, or PSYC100. Credit only granted for: FMSC460 or FMST460. Formerly: FMST460.
Theories of child, spouse, and elder abuse in the family setting. Emphasis on historical, psychological, sociological and legal trends relating to physical, emotional, and sexual abuse. Introduction to methods for prevention and remediation.

FMSC 477 Internship and Analysis in Family Science (3 credits)
Prerequisite: FMSC383; and 9 credits in FMSC courses; and permission of SPHL-Family Science department. Restriction: Must be in a major within SPHL-Family Science department. Credit only granted for: FMSC477, FMST347, or FMST477. Formerly: FMST477.
A supervised internship and a seminar requiring analysis. Opportunities to integrate theory and practice including 120 hours of contracted field experience. Summer or fall internship contracts due May 1; Spring contracts due December 1. See department for application procedures.

FMSC 480 Work and Family Issues and Programs (3 credits)
Credit only granted for: FMSC480 or FMST480. Formerly: FMST480.
The purpose, nature, organization and administration of work site, or employer-based, family support resources, including child and elder care referral and subsidies, parenting education, health and wellness programs, parental and sick child leaves, and flexible work scheduling.

FMSC 485 Introduction to Family Therapy (3 credits)
Prerequisite: FMSC330; or 1 course from PSYC300-499 course range. Credit only granted for: FMSC485 or FMST485. Formerly: FMST485.
The fundamental theoretical concepts and clinical procedures of marital and family therapy including premarital and divorce therapy issues.

FMSC 487 Legal Aspects of Family Problems (3 credits)
Credit only granted for: FMSC487 or FMST487. Formerly: FMST487.
Laws and legal procedures, with emphasis on adoption, marriage, divorce, annulment, and property rights, and how they affect family life.

FMSC 490 Family and Addiction (3 credits)
Prerequisite: SOCY100, SOCY105, or PSYC100; or permission of instructor.
Theory, research, and clinical practice in the area of addictions and recovery as they relate to family processes.

FMSC 497 The Child and the Law (3 credits)
Credit only granted for: FMSC497 or FMST497. Formerly: FMST497.
Legislation and case law regarding children's legal rights with emphasis on the rights of children in the juvenile justice system, and rights to medical, educational, and other social services.

FMSC 498 Special Topics: Family Science (1-3 credits)
Prerequisite: Permission of SPHL-Family Science department. Repeatable to 6 credits if content differs. Formerly: FMST498.
Special course topics in family studies.

FMSC 600 Family Theories (3 credits)
Credit only granted for: FMSC600 or FMST600. Formerly: FMST600.
An overview of the theoretical frameworks underlying research on the family. Survey of research findings.

FMSC 603 Programmatic Approaches to Family Problems (3 credits)
Credit only granted for: FMSC603 or FMST603. Formerly: FMST603.
Theories, assumptions, and principles that guide the design, implementation, and evaluation of family-focused prevention and intervention programs.

FMSC 606 Ethnic Families and Health Disparities (3 credits)
Credit only granted for: FMSC606 or FMST606. Formerly: FMST606.
Historical, psychosocial, economic, and political factors influencing the structure and functioning of ethnic families. Overview of racial and ethnic health disparities over the life course and ways in which they are influenced by multi-level contextual factors.

FMSC 610 Research Methods in Family Science (3 credits)
Prerequisite: EDMS645; or students who have taken courses with comparable content may contact the department. Credit only granted for: FMSC610 or FMST610. Formerly: FMST610.
Research methods in family science. The role of theory, design, use of qualitative and quantitative measurement techniques, data collection and data analysis. Development of research proposals.

FMSC 640 Family Therapy: Theory and Techniques (3 credits)
Credit only granted for: FMSC640 or FMST640. Formerly: FMST640.
Overview of fundamental theoretical concepts and clinical procedures in marital and family therapy, with an emphasis on those therapies which operate from a family systems perspective.

FMSC 641 Couples Therapy, Theory, and Techniques (3 credits)
Prerequisite: FMSC640. Credit only granted for: FMSC641 or FMSC641. Formerly: FMST641.
Overview of theoretical models of couple relationships and methods of facilitating growth and interaction within those relationships. Emphasis on couples with conflicting needs and expectations, and dysfunctional communication and conflict negotiation skills.

FMSC 642 Normal and Abnormal Individual and Family Development (3 credits)
Prerequisite: FMSC640. Credit only granted for: FMSC642 or FMST642. Formerly: FMST642.
Normal development and psychopathology in the family system. Emphasis on parent-child relationships and application of the current Diagnostic and Statistical Manual of Mental Disorders (DSM) to family therapy.

FMSC 645 Sexuality: Issues in Family Therapy and Service Delivery (3 credits)
Prerequisite: Must have completed a basic course in human sexuality. Restriction: Permission of instructor. Credit only granted for: FMSC645 or FMST645. Formerly: FMST645.
Typical, dysfunctional, and pathological sexual functioning: effects on individuals, couples, and family systems. Sensitizes students to sexual issues, explores how perceptions or such issues affect work with people, and emphasizes implications for marriage and family therapy.

FMSC 646 Sex Therapy: Theory, Skills, and Practice (3 credits)
Prerequisite: FMSC645; or permission of SPHL-Family Science department.
Introduction to the theory and practice of sex therapy, including information about human sexual function and dysfunction

and appropriate intervention methods. Emphasis on the relationship and the dynamics of sexual functioning within that system.

FMSC 647 Theory and Techniques of Family Mediation (3 credits)
Credit only granted for: FMSC647 or FMST647. Formerly: FMST647.
An introduction to family mediation as an approach to helping families deal effectively with the issues associated with separation and divorce. Theory, practice, and techniques of negotiation, with an emphasis on custody, property division, and the constructive restructuring of family relationships.

FMSC 650 Ethical, Legal, and Professional Principles in Marriage and Family Therapy (3 credits)
Prerequisite: Permission of SPHL-Family Science department. Restriction: Must be in Couple and Family Therapy (Master's) program. Credit only granted for: FMSC650 or FMST650. Formerly: FMST650.
An introduction to the basic principles and practices of family therapy. Emphasis on basic therapy skills applied to a family context and on professional ethics of the family practitioner. Addresses therapist's legal responsibilities and liabilities, certification, and licensure issues.

FMSC 651 Psychopathology in the Family Context (3 credits)
Prerequisite: FMSC650. Restriction: Must be in Couple and Family Therapy (Master's) program. Credit only granted for: FMSC651 or FMST651. Formerly: FMST651.
Diagnosis and treatment of psychopathology within the family context, with application of various family therapy models.

FMSC 652 Diagnosis and Treatment of Mental and Emotional Disorders in Family Systems (3 credits)
Prerequisite: FMSC651. Restriction: Must be in Couple and Family Therapy (Master's) program. Credit only granted for: FMSC652 or FMST652. Formerly: FMST652.
Systematic assessment, diagnosis, and treatment of mental and emotional disorders in couples and families. Utilization and critique of the current Diagnostic Statistical Manual Disorders (DSM).

FMSC 653 Advanced Application of MFT Models and Techniques (3 credits)
Prerequisite: FMSC652. Restriction: Must be in Couple and Family Therapy (Master's) program. Credit only granted for: FMSC653 or FMST653. Formerly: FMSC653.
Advanced application and integration of family therapy skills and theoretical models in the practice of marriage and family therapy. Emphasis on treatment plans from different therapeutic models demonstrated in case presentations and supervision of therapy.

FMSC 654 Clinical Marriage and Family Therapy Practice (3 credits)
Prerequisite: FMSC651. Restriction: Must be in Couple and Family Therapy (Master's) program. Credit only granted for: FMSC654 or FMST654. Formerly: FMST654.
Application of theory and technique to the clinical practice of marriage and family therapy. Emphasis on case management and clinic administration. Includes completion of 12 successive months and 500 hours of supervised, direct client contact with couples, families, and individuals from an integrative family systems perspective.

FMSC 658 Supervised Clinical Practice of Marriage and Family Therapy (1-3 credits)
Prerequisite: FMSC650. Restriction: Permission of instructor. Repeatable to 12 credits if content differs. Formerly: FMST658.
The supervision of marriage and family therapy client contact. Various family systems models of supervision applied via extant methods, including live, videotaped, and audiotaped.

FMSC 660 Program Planning and Evaluation in Family Science (3 credits)
Credit only granted for: FMSC660 or FMST660. Formerly: FMST660.
Theory and methods of program planning and evaluation with special emphasis on family programs. Assessment of program goals and the social and psychological factors involved in program implementation. Methods for measuring the effectiveness of program delivery, as well as the impact of services on family functioning.

FMSC 668 Special Topics in Family Sciences (1-3 credits)

FMSC 689 Research Internship (1-3 credits)
Prerequisite: Permission of instructor; and permission of SPHL-Family Science department. Repeatable to 3 credits if content differs. Formerly: FMST689.
Research experience resulting in a scholarly article suitable for publication in a peer-reviewed journal.

FMSC 698 Advanced Topics in Family Science (1-3 credits)
Repeatable to 12 credits. Formerly: FMST698.
Arranged group study on specific topic which may vary from term to term.

FMSC 699 Independent Study (1-6 credits)
Prerequisite: Permission of SPHL-Family Science department. Restriction: Permission of instructor. Repeatable to 6 credits. Formerly: FMST699.

FMSC 700 Application of Advanced Quantitative Methods in Family Research (3 credits)
Prerequisite: EDMS646. And FMSC610; or students who have taken courses with comparable content may contact the department. Formerly: FMST698R (Spring 2007) and FMSC698R (Spring 2008).
Optimal use of various designs, statistical methods and procedures in behavioral research in families.

FMSC 710 Maternal and Child Health from a Life Course Perspective (3 credits)
Credit only granted for: FMSC710 or FMST710. Formerly: FMST710.
Survey of current science in maternal and child health informed by a life course perspective. The surveyed topics include inutero exposure to toxins, feeding and growth, and effects of chronic stress, maternal and child health.

FMSC 720 Study Design in Maternal Child Health Epidemiology (3 credits)
Prerequisite: EPIB650, EPIB610, and EPIB611. Recommended: FMSC710. Also offered as: EPIB612. Credit only granted for: EPIB612 or FMSC720.
A detailed survey of key epidemiologic study designs provided through readings, lectures, and exercises. Lectures begin by considering the evolution of epidemiologic thought and parallel developments in design of epidemiologic studies. Topics covered include assessment of causality in observational studies, investigation of acute outbreaks, survey design, cohort and case-control study designs, clinical randomized trials, and discussion of issues pertaining to measurement error in the assessment of exposures and outcomes in epdemiologic studies.

FMSC 730 Key Topics in Maternal and Child Health (3 credits)
Restriction: Permission of instructor.
Review of key issues on the frontier of maternal and child health research and practice within broad public health and socio-cultural context. Examines current maternal and child health issues such as

ethics, child and family health, health and socioeconomic disparities, child nutrition and obesity, military family health, and global health.

FMSC 745 Gender and Ethnicity in Family Therapy and Service Delivery (3 credits)
Credit only granted for: FMSC745 or FMST745. Formerly: FMST745.
Major critiques of sources of racial, cultural, and gender bias in marital and family therapy and family service delivery. Addresses these issues in program development and clinical practice.

FMSC 750 Family and Health Policy (3 credits)
Credit only granted for: FMSC750 or FMST750. Formerly: FMST750.
Development and analysis of public policies affecting the health and well-being of children, youth, and families, with an emphasis on low income and ethnic minority populations. Examination of social, economic, and political dynamics that influence family and health policies and the delivery of health care. Introduction to health advocacy within the US public health system.

FMSC 758 Supervision of Marriage and Family Therapy Supervision (1-3 credits)
Prerequisite: Permission of SPHL-Family Science department. Repeatable to 12 credits if content differs. Formerly: FMST758.
Designed to provide supervision of marriage and family therapy supervision. Limited to students who have completed a Marriage and Family Therapy (MFT) Program or its equivalent, have completed an approved MFT supervision course, and are supervisors-in-training. Supervised supervision will incorporate various family systems, models and methods.

FMSC 760 Legal Issues & Families (3 credits)
Credit only granted for: FMSC760 or FMST760. Formerly: FMST760.
Analysis of marriage and family issues from a legal perspective. Review of legal decisions affecting families, including procreative rights, marriage, termination of marriage, parental and child rights, adoption, child custody, and child/family medical treatment. Relationship between family law and family policy.

FMSC 780 Qualitative Methods in Family and Health Research (3 credits)
Credit only granted for: FMSC780 or FMST780. Formerly: FMST780.
Theoretical perspectives and methodological tools to conduct research with individuals and families across the life span. Review of research designs, participant fieldwork, observation and interview projects, data collection, computer-assisted data analysis, and development of grounded theory.

FMSC 789 Non-Thesis Research (1-3 credits)
Repeatable to 6 credits if content differs. Formerly: FMST789.
Non-thesis option research papers.

FMSC 790 Marriage and Family Therapy Supervision (3 credits)
Prerequisite: Permission of SPHL-Family Science department. Credit only granted for: FMSC790, FMST690, or FMST790. Formerly: FMST790.
Theory and research in supervision of marriage and family therapy. Emphasis on major models, articulation of personal model, and demonstration of perceptual, conceptual, and executive skills in marriage and family therapy supervision. Designed to meet the didactic course component of the designation of Approved Supervisor of the American Association for Marriage and Family Therapy.

FMSC 799 Master's Thesis Research (1-6 credits)
Formerly: FMST799.

FMSC 810 Theory in Family Systems and Family Health (3 credits)
Restriction: Permission of instructor. Credit only granted for: FMSC810, FMST698P, or FMST810. Formerly: FMST810.
Theory and research on family interaction and family coping with normative health and mental health transitions and non-normative crises across the family life cycle. Micro-analysis of family process in communication, decision-making, problem-solving, and compliance to health regimens. Examination of dysfunctional patterns and effective coping strategies.

FMSC 850 Maternal & Child Health Epidemiology (3 credits)
Restriction: Permission of instructor. Credit only granted for: FMSC850, FMST698P, or FMST850. Formerly: FMST850.
Determinants and trends in Maternal and Child Health, including analysis of the role of economic inequalities, race and ethnicity, community contexts, and psychosocial factors across the life course. Overview of methods and data systems used to monitor Maternal and Child Health. Development of a complete population health study.

FMSC 879 Preparing Future Faculty and Professionals Seminar (1 credits)
Restriction: Must be in one of the following programs (Family Science (Doctoral); Maternal and Child Health (Doctoral)). Repeatable to 4 credits.
Development of skills necessary to obtain and succeed in academic and non-academic positions in family science and public health. Topics include: career mapping, networking, teaching/teaching portfolios, independent research, publishing, grant writing, program and policy evaluation, consulting, job search, interviewing and negotiation, mentoring, diversity, work-family balance, and ethical issues in the workplace. Periodic visits to universities and government/nonprofit employers.

FMSC 898 Pre-Candidacy Research (1-8 credits)
Formerly: FMST898.

FMSC 899 Doctoral Dissertation Research (1-8 credits)
Formerly: FMST899.

Foreign Language (FOLA)

FOLA 408 Foreign Language I (3 credits)
Intensive study of a foreign language or related topic not available under one of the current foreign language departments or programs. May not be used to fulfill the arts and humanities language requirement.

FOLA 409 Foreign Language II (3 credits)
Prerequisite: FOLA408; and pre-requisite must be in corresponding subject language.
A continuation of FOLA 408. May not be used to fulfill arts and humanities language requirement.

FOLA 459 Foreign Literature in Translation (3 credits)
Repeatable to 6 credits if content differs.
Reading and discussion of selected authors, periods or genres of a foreign literature not otherwise offered. All readings and instruction in English.

French (FREN)

FREN 400 Applied Linguistics (3 credits)
The nature of applied linguistics and its contribution to the effective teaching of foreign languages. Comparative study of English and French, with emphasis upon points of divergence.

FREN 401 Writing with Style (3 credits)
Prerequisite: FREN301; or permission of ARHU-School of Languages, Literatures, and Cultures department.

Advanced composition and stylistic analysis.

FREN 404 Issues in the French-Speaking World Today (3 credits)
Prerequisite: FREN312 or FREN311; or permission of ARHU-School of Languages, Literatures, and Cultures department.
A sociocultural and historical approach to relevant issues affecting contemporary French civilization. Press articles and television programs will be the basis for classroom cultural analysis and oral communication.

FREN 406 Commercial French II (3 credits)
Prerequisite: FREN306; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Advanced study of commercial French language--terminology and style--leading to preparation for the Paris Chamber of Commerce Examination.

FREN 407 History of the French Language (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department.
Evolution of the French language from Latin to modern French. Taught in French.

FREN 421 Francophone African Film (3 credits)
Also offered as: FILM421. Credit only granted for: FREN421 or FILM421.
Imaginary and Memory in the reality of Francophone African Film from 1960-present. Taught in English.

FREN 423 Women and French Cinema (3 credits)
Also offered as: FILM423. Credit only granted for: FREN423 or FILM423.
Cultural identity, social boundaries and gender roles in French film as well as introduction to film textual analysis and diverse film theories (semiotics, film and psychoanalysis, feminist film theory, structuralism, narratology, spectatorship and cultural studies). Taught in French.

FREN 429 Studies in French Literature and Culture of the Renaissance (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Selected topics in French literature of the Renaissance.

FREN 439 Studies in 17th Century French Literature and Culture (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Selected topics in seventeenth-century French literature.

FREN 449 Studies in 18th Century French Literature and Culture (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Selected topics in eighteenth-century French literature.

FREN 459 Studies in 19th Century French Literature and Culture (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Selected topics in nineteenth-century French literature.

FREN 469 Studies in 20th Century French Literature and Culture (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Selected topics in twentieth-century French literature.

FREN 471 The Construction of French Identity I: From the Origins to the Age of Versailles (3 credits)
French life, customs, culture, traditions (800-1750).

FREN 472 The Construction of French Identity II: From the Revolution to the Early Twentieth Century (3 credits)
French life, customs, culture, traditions (1750 to the early twentieth century).

FREN 473 The Construction of French Identity III: Cross-Cultural Approaches to the Study of Contemporary French Society (3 credits)
Patterns of communication, mythology, and ideology in modern France, from the Third Republic to the present, through historical and cross-cultural approaches, with reference to the Francophone world.

FREN 474 Contemporary France: A Sociocritical Approach (3 credits)
Recommended: FREN473.
A sociocritical approach to understanding modern French society through the study of print and non-print media documents (autobiography, film, and paraliterature), with reference to the Francophone world.

FREN 478 Themes and Movements of French Literature in Translation (3 credits)
Studies treatments of thematic problems or literary or historical movements in French literature. Topic to be determined each semester. Taught in English.

FREN 479 Masterworks of French Literature in Translation (3 credits)
Treats the works of one or more major French writers. Topic to be determined each semester. Taught in English.

FREN 480 French Cinema: A Cultural Approach (in Translation) (3 credits)
Also offered as: FILM420. Credit only granted for: FREN480 or FILM420.
A study of French culture, civilization, and literature through the medium of film. Taught in English.

FREN 482 Gender and Ethnicity in Modern French Literature (3 credits)
Literature by women writers of France and other French speaking areas with a focus on the relationship between gender, ethnicity and writing. Taught in English.

FREN 488 Special Topics in Francophone Studies (3 credits)
Repeatable to 9 credits if content differs.
Topic and language of instruction to be announced when offered.

FREN 489 Seminar in Themes or Movements of French Literature (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.

FREN 495 Honors Thesis Research (3 credits)
Restriction: Must be admitted to the departmental honors program.
The writing of a paper under the direction of a professor in this department and an oral examination. Required to fulfill the departmental honors requirement.

FREN 498 Special Topics in French Literature (3 credits)
Prerequisite: FREN351 or FREN352; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.

FREN 499 Special Topics in French Studies (3 credits)
Repeatable to 6 credits if content differs.
An aspect of French studies, the specific topic to be announced each time the course is offered.

FREN 600 Introduction to Literary Theory (3 credits)

FREN 601 The History of the French Language (3 credits)

FREN 603 Advanced Translation (3 credits)
Advanced translation (French/English, English/French) and comparative stylistic analysis.

FREN 609 Special Topic in the French Language (3 credits)

FREN 610 Issues and Research Findings in French as a Foreign/Second Language (3 credits)
Theories and research findings in SLA as they pertain to the acquisition of French in different environments.

FREN 611 The Structure of the French Language (3 credits)
Phonology, morphology, syntax and semantics of modern French. Collection and critical analysis of language data.

FREN 619 Special Topic in Medieval French Literature (3 credits)

FREN 629 Special Topic in Sixteenth Century French Literature (3 credits)

FREN 639 Special Topic in Seventeenth Century French Literature (3 credits)

FREN 649 Special Topic in Eighteenth Century French Literature (3 credits)

FREN 659 Special Topic in Nineteenth Century French Literature (3 credits)

FREN 665 The French Theatre in the Twentieth Century (3 credits)

FREN 669 Special Topics in Twentieth Century French Literature (3 credits)

FREN 679 The History of Ideas of France (3 credits)
Analysis of currents of ideas as reflected in different periods and authors of French literature.

FREN 689 Seminar in a Great Literary Figure (3 credits)

FREN 699 Seminar (3 credits)
Topic to be determined each semester.

FREN 709 College Teaching of French (1 credits)
Repeatable to 2 credits.
Introduction to the teaching of French at the college level with particular emphasis on methodology. Seminars in theory, demonstration of different teaching techniques, supervised practice teaching, training in language laboratory procedures, evaluation of instructional materials. Required of all graduate assistants in French.

FREN 798 Master's Independent Study (1-3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 3 credits.

FREN 799 Master's Thesis Research (1-6 credits)

FREN 818 French Literary Criticism (3 credits)
Analysis and evaluation of various trends in literary criticism. Topic to be determined each semester.

FREN 889 Doctoral Independent Study (3 credits)
Repeatable to 6 credits.

FREN 898 Pre-Candidacy Research (1-8 credits)
Repeatable to 6 credits.

FREN 899 Doctoral Dissertation Research (1-8 credits)

Geography (GEOG)

GEOG 410 Washington, D.C.: Past and Present (3 credits)
Credit only granted for: GEOG410 or GEOG454. Formerly: GEOG454.
This course is designed as a field study of Washington, D.C. from its origin as the Federal Capital to its role in the development of the metropolitan area. Through lectures and extensive field trips, the course will focus on the symbiosis and interrelation of Washington, D.C. and its region: historical, socio-economic, spatial and environmental.

GEOG 413 Migration: Latin America and the United States (3 credits)
Prerequisite: GEOG313; or permission of BSOS-Geography department. Recommended: HIST250; or USLT201; or LASC234. Credit only granted for: GEOG413, or GEOG498M. Formerly: GEOG498M.
Develops an understanding of the push and pull factors that have contributed to human mobility (migration) that has transformed the Americas. The class is divided in two parts: immigration and emigration from Latin American and Latin America migration to the United States. We will be interested in studying the migration shifts that have occurred in Latin America and the theories that help explain them. The themes that will be addressed are the history of migration with Latin America and to North America, the impact of this migration on both sending and receiving countries, and the various policy strategies and issues concerning migration.

GEOG 415 Land Use, Climate Change, and Sustainability (3 credits)
Prerequisite: GEOG123 or GEOG306; or permission of BSOS-Geography department. Recommended: GEOG340; or GEOG342; or GEOG331. Or GEOG201; and GEOG211. Credit only granted for: GEOG415 or GEOG498D. Formerly: GEOG498D.
The issues of climate change and land use change as two interlinked global and regional environmental issues and their implications for society and resource use are explored.

GEOG 416 Conceptualizing and Modeling Human-Environmental Interactions (3 credits)
Prerequisite: Permission of BSOS-Geography department. Or GEOG306, STAT100, or MATH111; and (GEOG201 and GEOG202); and (GEOG331 or GEOG330). Corequisite: MATH130, MATH140, or MATH220. Credit only granted for: GEOG416 or GEOG498N. Formerly: GEOG498N.
Develops skills to carry out research that

integrates environmental and economic aspects of sustainability by introducing extensively used quantitative tools for analyzing human-environmental interactions in the field of ecological economics. These include, e.g., index number calculations and decomposition analysis, Environmental Kuznets Curve (EKC), environmental input-output analysis and life-cycle analysis, and multi-criteria decisions aid (MCDA). Students will need laptops to run models during class.

GEOG 417 Land Cover Characterization Using Multi-Spectral Remotely Sensed Data Sets (3 credits)

Prerequisite: Permission of BSOS-Geography department. Or GEOG372; and GEOG472; and GEOG306. Also offered as: GEOG417. Credit only granted for: GEOG498R; GEOG788R; GEOG417; GEOG617. Formerly: GEOG498R.

Students will be introduced to the image processing steps required for characterizing land cover extent and change. Key components of land cover characterization, including image interpretation, algorithm implementation, feature space selection, thematic output definition, and scripting will be discussed and implemented.

GEOG 418 Field and Laboratory Techniques in Environmental Science (1-3 credits)

Restriction: Permission of BSOS-Geography department. Credit only granted for: GEOG418 or GEOG448. Formerly: GEOG448.

Lecture and laboratory learning each week. A variable credit course that introduces field and laboratory analyses in environmental science. Individual learning contract are developed with instructor.

GEOG 431 Culture and Natural Resource Management (3 credits)

Credit only granted for: GEOG421 or GEOG431. Formerly: GEOG421.

Basic issues concerning the natural history of humans from the perspective of the geographer. Basic components of selected behavioral and natural systems, their evolution and adaptation, and survival strategies.

GEOG 432 Spatial Econometrics (3 credits)

Prerequisite: Permission of BSOS-Geography department. Or GEOG201; and GEOG202; and GEOG306; and GEOG332. Also offered as: GEOG732. Credit only granted for: GEOG498E, GEOG432, GEOG788E, GEOG732. Formerly: GEOG498E.

An introduction to modern econometric techniques in general and spatial econometrics in particular, using the popular open source statistical computer language R. A focus on using statistical computing to produce analytical reports for real-world applications, research papers, and dissertations.

GEOG 434 The Contemporary City (3 credits)

Credit only granted for: GEOG434 or GEOG450. Formerly: GEOG450.

The contemporary urban system: towns, cities and metropolitan areas and their role as concentrations of social and economic activity. Patterns of land-use: residential, employment, commercial activity, manufacturing, and transportation. Explanatory and descriptive models. International comparisons.

GEOG 437 Political Geography (3 credits)

Credit only granted for: GEOG423 or GEOG437. Formerly: GEOG423.

Geographical factors in the national power and international relations; an analysis of the role of geopolitics and geostrategy, with special reference to the current world scene.

GEOG 438 Seminar in Human Geography (3 credits)

Recommended: GEOG201; or GEOG211. Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.

Selected topics in human geography.

GEOG 441 The Coastal Ocean (3 credits)

Prerequisite: GEOG140; or students who have taken courses with comparable content may contact the department; or permission of BSOS-Geography department. Credit only granted for: GEOG441 or GEOG498C. Formerly: GEOG498C.

Introduction to coastal oceanography, focusing on the physical, biological, and geological aspects of ocean areqs on the inner continental shelves. Wave, currents, and tidal dynamics of bays, open coast, estuaries, and deltas. Sedimentary environments of major coastal types. Ecology and biogeochemical relationships, including benthic and planktonic characteristics. Coastal evolution with sea level rise. Human impacts: eutrophication, modification of sedimentation. The coastal future: rising sea level, hypoxia, and increased storminess.

GEOG 442 Biogeography and Environmental Change (3 credits)

Prerequisite: GEOG342; or students who have taken courses with comparable content may contact the department. Recommended: GEOG123. Credit only granted for: GEOG442, GEOG447, or GEOG484. Formerly: GEOG447.

Biogeographical topics of global significance, including a consideration of measurement techniques, and both descriptive and mechanistic modeling. Topics may include: scale in biogeography, climate and vegetation, global carbon cycle, biodiversity, interannual variability in the biosphere, land cover, global biospheric responses to climate change, NASA's Mission to Planet Earth and Earth Observation System.

GEOG 445 Climatology (3 credits)

Prerequisite: GEOG345. Credit only granted for: GEOG445 or GEOG446. Formerly: GEOG446.

Quantitative investigations into the Earth's radiation balance, water cycle, and the interrelationship of climate and vegetation. Methodologies in climate research. Case studies related to global climatic change.

GEOG 458 Special Topics in Study Abroad IV (1-6 credits)

Repeatable to 15 credits if content differs.

Special topics course taken as part of an approved study abroad program.

GEOG 472 Remote Sensing: Digital Processing and Analysis (3 credits)

Prerequisite: GEOG372 and GEOG306; or students who have taken courses with comparable content may contact the department. Credit only granted for: GEOG472 or GEOG480. Formerly: GEOG480.

Digital image processing and analysis applied to satellite and aircraft land remote sensing data. Consideration is given to preprocessing steps including calibration and geo registration. Analysis methods include digital image exploration, feature extraction thematic classification, change detection, and biophysical characterization. One or more application examples may be reviewed.

GEOG 473 Geographic Information Systems and Spatial Analysis (3 credits)

Prerequisite: GEOG306 and GEOG373; or students who have taken courses with comparable content may contact the department. Credit only granted for: GEOG473 or GEOG482. Formerly: GEOG482.

Analytical uses of geographic information systems; data models for building geographic data bases; types of geographic data and spatial problems; practical experience using advanced software for thematic domains such as terrain analysis, land suitability modeling, demographic analysis, and transportation studies.

GEOG 475 Computer Cartography (3 credits)

Prerequisite: GEOG373 and GEOG306. Credit only granted for: GEOG471 or GEOG475. Formerly: GEOG471.
Advanced skills of computer mapping using more sophisticated software packages. Map projection evaluation and selection, coordinate system conversion, techniques of quantitative thematic mapping, map design and generalization, hypermedia and animated cartography. Emphasis on designing and making cartographically sound sophisticated thematic maps.

GEOG 476 Object-Oriented Computer Programming for GIS (3 credits)

Prerequisite: GEOG373 and GEOG376; or permission of BSOS-Geography department. And must have completed or be concurrently enrolled in MATH220, MATH130, or MATH140. Restriction: Must be in Geography program; or must be in GIS minor. Credit only granted for: GEOG498G or GEOG476. Formerly: GEOG498G.
Expands on conceptual and practical aspects of programming for geographic applications. The main focus of this course is to provide students more advanced programming in object oriented programming languages (i.e. Python). In addition, students will develop a proficiency in applying these advanced programming principles to manipulating spatial data sources within the Geographic Information Systems (GIS).

GEOG 498 Topical Investigations (1-3 credits)

Prerequisite: Restricted to advanced undergraduate students; and 24 credits in GEOG courses. Or restricted to graduate students. Repeatable to 6 credits if content differs.
Independent study under individual guidance.

GEOG 506 Introduction to Quantitative Methods for the Geographic Environmental Sciences (3 credits)

Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program.
Essentials in the quantitative analysis of spatial and other data, with a particular emphasis on statistics and programming. Topics include data display, data description and summary, statistical inference and significance tests, analysis of variance, correlation, regression, and spatial statistics. Students will develop expertise in data analysis using advanced statistical software.

GEOG 579 Introduction to Remote Sensing and GIS (2-4 credits)

Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program.
Introduction to remote sensing and geographic information systems. Topics include methods of obtaining quantitative information from remotely sensed images, interpretation of remotely sensed images for spatial and environmental relationships, characteristics and organization of geographic data, including spatial data models for thematic mapping and map analysis and use of GIS in society, government, and business. Practical experience with remote sensing software and GIS.

GEOG 600 Introduction to Human Geography (3 credits)

Restriction: Permission of BSOS-Geography department.
Introduces students to current trends and developments in human geography in the areas of geography as social science, space and place, and human dimensions of global change, and to research procedures in this field.

GEOG 602 Introduction to Physical Geography (3 credits)

Restriction: Permission of BSOS-Geography department.
Introduces students to current trends and developments in physical geography and to research procedures in the field.

GEOG 603 Masters Research Tutorial (3 credits)

Prerequisite: GEOG600. Restriction: Permission of BSOS-Geography department. Credit only granted for: GEOG603 or GEOG610. Formerly: GEOG610.
Development of Masters scholarly paper topic, critical literature review, formulation of geographical approach to research methodology. Individual meetings with faculty. Comprehensive exam before the end of the semester.

GEOG 606 Quantitative Spatial Analysis (3 credits)

Prerequisite: GEOG305; or permission of BSOS-Geography department. Credit only granted for: GEOG605 or GEOG606. Formerly: GEOG605.
Multivariate statistical method applications to spatial problems. Linear and non-linear correlation and regression, factor analysis, cluster analysis. Spatial statistics including: trend surfaces, sequences, point distributions. Applications orientation.

GEOG 608 Comprehensive Portfolio Assessment Summary (1-3 credits)

Repeatable to 3 credits.
Evaluation of a PhD student's portfolio.

GEOG 609 Seminar in Remote Sensing (3 credits)

Prerequisite: GEOG480. Repeatable to 6 credits if content differs.
Topics in Remote Sensing: These may include agricultural, forestry, coastal environments, urban environments, and other major applications of remote sensing. Also may focus on new and existing earth observation missions dedicated to land research.

GEOG 614 Human Dimensions of Global Change (3 credits)

The intersection of human and biophysical systems from the vantage point of the impact of human actions on the environment are examined. The impact of the biophysical environment on humans is also discussed.

GEOG 615 Land Cover and Land Use Change (3 credits)

Prerequisite: GEOG442, GEOG472, GEOG435, or GEOG473; or permission of BSOS-Geography department.
This class provides an examination of land cover and land use change science, addressing the causes, impacts and projection of change. Key concepts of land use science are presented and recent research papers and case studies are reviewed. Class consists of lectures, invited presentations and individual student projects and presentations.

GEOG 617 Land Cover Characterization Using Multi-Spectral Remotely Sensed Data Sets (3 credits)

Prerequisite: Permission of BSOS-Geography department. Or GEOG372; and GEOG472; and GEOG306. Also offered as: GEOG417. Credit only granted for: GEOG498R; GEOG788R; GEOG417; GEOG617. Formerly: GEOG788R.
Students will be introduced to the image processing steps required for characterizing land cover extent and change. Key components of land cover characterization, including image interpretation, algorithm implementation, feature space selection, thematic output definition, and scripting will be discussed and implemented.

GEOG 618 Seminar in Geomorphology (3 credits)

Selected topics; this can include discussion of empirical and theoretical research methods applied to geomorphological problems including review of pertinent literature.

GEOG 628 Seminar in Climatology (3 credits)

Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in climatology chosen to fit the individual needs of advanced students.

GEOG 630 Climate, Energy, and Policy (3 credits)
Prerequisite: Permission of BSOS-Geography department; or enrolled in the Geographical Sciences Graduate Program(s). Credit only granted for: GEOG430, GEOG630, or GEOG788E. Formerly: GEOG788E. Additional information: This course will make occasional use of the popular open source statistical computer language R for practical workshops.
Students will learn about climate change and energy policy from multiple perspectives including social economic, technological, scientific, and behavioural aspects and their interdependence. The course will also consider the report of the Intergovernmental Panel on Climate Change on mitigation and applied cost/benefit analysis of Climate Change.

GEOG 632 Economic Geography (3 credits)
Restriction: Permission of BSOS-Geography department.
An advanced graduate level introduction to the effects of geography on economic activities and the effects of economic incentives, institutions, and activities on the nature and sustainability of human and environmental geographic systems.

GEOG 635 Population and Environment (3 credits)
Credit only granted for: GEOG635 or GEOG788B. Formerly: GEOG788B.
Course explores the reciprocal relationship between human and phyical systems that result in changes in the environment. Focuses on the roles of demographic variables of population growth and migration and physical envronmental variables from both a historic and recent time frame. These processes will be examined at various scales, from local changes to global changes.

GEOG 636 Qualitative Methods in Geography (3 credits)
Restriction: Permission of BSOS-Geography department. Formerly: GEOG648C.
Use of qualitative methods for qualitative geographic research. Design procedures and analysis of qualitative studies are the focus of the course. Includes readings and trying out various methods. Students will be able to present their own research and use it as an example throughout the course.

GEOG 638 Seminar in Biogeography (3 credits)
Prerequisite: Must have completed 6 credits of biogeography or ecology; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Topics in Biogeography: Biological aspects of Geography. These may include ecology, biodiversity, climate-vegetation interactions, impacts of global change.

GEOG 639 Seminar in Physical Geography (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Examination of selected themes and problems in physical geography.

GEOG 642 Biogeography and Environmental Change (3 credits)
Restriction: Permission of BSOS-Geography department. Also offered as: GEOG442. Credit only granted for: GEOG788C, GEOG642, or GEOG442. Formerly: GEOG788C.
Biogeographical topics of global significance, including a consideration of measurement techniques, and both descriptive and mechanistic modeling. Topics may include: scale in biogeography, biodiversity, carbon geography, climate and vegetation, interannual variability in the biosphere, land cover, global biospheric responses to climate change, NASA's Mission to Planet Earth and Earth Observation System. The class focuses on both natural and athropogenic controls, impacts of biography on climate and ecosystem services and different methods in biogeography.

GEOG 646 Watershed Hydrology, Modeling, and Policy (3 credits)
Restriction: Permission of BSOS-Geography department; or must be in one of the following programs (Geography (Doctoral); Geography (Master's)). Credit only granted for: GEOG646 or GEOG779A. Formerly: GEOG779A.
Introduction to physical watershed hydrology/nonpoint water pollution, basic concepts of computer simulation models for watershed science, and conservation issues related to watershed management.

GEOG 648 Seminar in Cultural Geography (3 credits)
Repeatable to 6 credits if content differs.
Examination of selected themes and problems in cultural geography.

GEOG 650 MOBILE GIS (3 credits)
Prerequisite: GEOG657. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in Graduate Certificate: Professional Studies-Geospatial Information Sciences.
This course covers how to create, test, and publish mobile GIS applications that work across multiple platforms (Android, iOS, and Black Berry Tablet OS) and adapt to a smartphone or tablet display.

GEOG 651 Spatial Statistics (3 credits)
Prerequisite: GEOG615; or students who have taken courses with comparable content may contact the department. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in Graduate Certificate: Professional Studies-Geospatial Information Sciences.
This course is about quantitative analysis of spatial data. It is intended to provide a broad survey of various methods of exploratory statistical data analysis most useful in environmental and social sciences. The course is a mix of theory, methods, and applications geared towards helping students: (1) develop an understanding of the important theoretical concepts in spatial data analysis; and (2) gain practical experience in application of spatial statistics to a variety of social and environmental problems using advanced statistical software.

GEOG 652 Digital Image Processing and Analysis (3 credits)
Prerequisite: GEOG579 or GEOG506; or students who have taken courses with comparable content may contact the department. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in the Geospatial Information Sciences (Graduate Certificate) program.
Digital image processing and analysis applied to satellite and aircraft land remote sensing data. Consideration is given to preprocessing steps including calibration and geo registration. Analysis methods include digital image exploration, feature extraction thematic classification, change detection, and biophysical characterization. One or more application examples may be reviewed.

GEOG 653 Spatial Analysis (3 credits)
Prerequisite: GEOG579 or GEOG506; or students who have taken courses with comparable content may contact the department. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in the Geospatial Information Sciences (Graduate Certificate) program.
Methods of spatial analysis including measuring aspects of geometric features and identifying spatial patterns of geospatial objects that are represented as point, line, network, areal data, and 3-D surfaces.

GEOG 654 GIS and Spatial Modeling (3 credits)
Prerequisite: GEOG653. Restriction:

Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in Graduate Certificate: Professional Studies-Geospatial Information Sciences.
Provide foundations and understanding on various issues related to modeling and simulation in GIS context. It will addresses the concepts, tools, and techniques of GIS modeling, and presents modeling concepts and theory as well as provides opportunities for hands-on model design, construction, and application. The focus will be on raster-based modeling. This course is also application-orientated, particularly in these fields such as terrain modeling, LULC modeling, hydrological modeling, suitability modeling, etc.

GEOG 655 Spatial Database System (3 credits)

Prerequisite: GEOG653. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in Graduate Certificate: Professional Studies-Geospatial Information Sciences.
This course is designed to help students understand, analyze, design, and implement spatial databases. While the basic concepts and theories of database will be introduced, the focus of this course will be on providing students with hands-on experiences to practice the technical skills used in spatial database design and implementation. SQL, Oracle, and ArcSDE are the key topics.

GEOG 656 Programming and Scripting for GIS (3 credits)

Prerequisite: GEOG653. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in Graduate Certificate: Professional Studies-Geospatial Information Sciences.
An introduction to programming and scripting for intermediate GIS users. The fundamental concepts of computer programming will be introduced within the Geoprocessing framework in ArcGIS primarily using Python. Basic concepts of object-oriented programming and scripting will be presented. Students will develop skills in programming techniques to explore, manipulate and model spatial data using the Geoprocessor methods.

GEOG 657 Web Programming (3 credits)

Prerequisite: GEOG653. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in Graduate Certificate: Geospatial Information Sciences program. Credit only granted for: GEOG657 or GEOG788R. Formerly: GEOG788R.
Intermediate course designed to teach students the techniques for Web development, particularly creating dynamic and data-driven Web applications. Introduces a high-level, object-oriented programming language such as VB.Net and the designing, coding, debugging, testing, and documenting for the development of Web-based applications. Other popular Web development tools such as DHTML, CSS and PHP are also covered.

GEOG 658 Seminar in Historical Geography (3 credits)

Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
An examination of themes and problems in historical geography with reference to selected areas.

GEOG 660 Advanced Remote Sensing Using Lidar (3 credits)

Prerequisite: GEOG652. Recommended: GEOG656 and GEOG654. Credit only granted for: GEOG660 or GEOG788G. Formerly: GEOG788G.
Lidar, also known as laser scanning, is an active remote sensing tool that can produce high-resolution point clouds. Lidar is being applied to problems such as terrain modeling, biomass estimation, change detection, feature extraction, and measuring tree canopy. Topics covered are fundamentals of lidar, current developments in lidar technology, and different applications where lidar is being used. Students will get hands-on learning about lidar data management, processing, and analysis.

GEOG 668 Seminar in Economic Geography (3 credits)

Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Examination of themes and problems in the field of economic geography.

GEOG 671 Remote Sensing Instruments and Observtions (3 credits)

Prerequisite: GEOG472; or students who have taken courses with comparable content may contact the department; or permission of BSOS-Geography department.
Detailed examination of land remote sensing instruments, observatories and resultant measurements in the optical portion of the EM spectrum. Includes computer-based exercises that examine the importance of data geo-registration and radiometric calibration in land measurements.

GEOG 672 Biophysics of Optical Remote Sensing (3 credits)

Prerequisite: GEOG472; or students who have taken courses with comparable content may contact the department; or permission of BSOS-Geography department.
Biophysical principles, phenomena and processes underlying multispectral remote sensing in the optical portion of the EM spectrum. Includes computer-based exercises that explore the biophysical basis of land patterns and dynamics observed in remote sensing data.

GEOG 673 GIS Modeling (3 credits)

Prerequisite: GEOG306 and GEOG473; or students who have taken courses with comparable content may contact the department. Credit only granted for: GEOG673 or GEOG695. Formerly: GEOG695.
Process modeling and spatial analysis within the GIS context. Introducestheoretical fundamentals and conceptual approaches to frame and represent geographical phenomena and spatial decision making.

GEOG 674 GIS Spatial Databases (3 credits)

Prerequisite: GEOG473; or students who have taken courses with comparable content may contact the department. Credit only granted for: GEOG674 or GEOG696. Formerly: GEOG696.
Introduces fundamental concepts and practical skills required to design, implement and use GIS databases. Students will learn to store and represent geospatial data in databases, design and create a spatial database, manage and query geospatial data, and deliver and present geospatial data.

GEOG 676 Advanced Programming for Geography and Remote Sensing (3 credits)

Prerequisite: GEOG376; or permission of BSOS-Geography department.
Comprehensive instruction is provided in the advanced use of a commercial programming language and analysis tool used for scientific programming and data visualization, with an emphasis on applications in geography and remote sensing or GIS.

GEOG 677 Internet GIS (3 credits)

Recommended: GEOG676. Restriction: Permission of BSOS-Geography department.
Online course delivers information on the use of GIS applications on the Internet. Covers hardware/software structure of the Internet, the means for communicaton between Internet-connected devices, applications that provide GIS program and data, and performance and security concerns.

GEOG 679 Seminar in Urban Geography (3 credits)

Repeatable to 6 credits if content differs.
Post-industrial urbanization; urban planning and management; metropolitan systems; internal structure of the city; use

of techniques in urban locational research; transportation and land use.

GEOG 681 Introduction to Computational Social Science (3 credits)
Credit only granted for: GEOG681 or GEOG788W. Formerly: GEOG788W.
Introduction to Computational Social Science serves as an introduction to the basis for computational social science (CSS) across diverse disciplines and topics at the intersection of the socio-behavioral sciences, physical sciences, and computing sciences. We will explore the foundations for CSS in different subject domains, as the methods used to build representations of social science entities, phenomena, and processes in computational media. We will also critique applied computational social science as it relates to topics that cut across the socio-behavioral sciences, or that specialize within particular socio-behavioral science domains.

GEOG 688 Seminar in Third World Devlopment (3 credits)
Selected topics in international development for the advanced student. Core-periphery spatial exchanges, location and accessibility issues, resource constraints and opportunities, planning for rural and agricultural development, urbanization processes, emerging regional patterns.

GEOG 694 Computerized Map Projections and Transformations (3 credits)
Prerequisite: GEOG694; or students who have taken courses with comparable content may contact the department; or permission of BSOS-Geography department.
Computer generated projections; techniques for transforming one coordinate system to another; software for producing different map projections; mathematical and perceptual problems in producing and using projections.

GEOG 695 Spatial Models (3 credits)
Prerequisite: GEOG605 and GEOG483; or students who have taken courses with comparable content may contact the department.
Mathematical and other models for varied subject matter. Models for point, line, area, surface spatial data contexts. Descriptive and normative models. Aggregate and dis-aggregate models. Tools for research, planning, decision making. Information systems context. Intuitive understanding emphasized. Practical experience using several computer tools.

GEOG 698 Seminar in Cartography (1-6 credits)
Repeatable to 6 credits if content differs.
Selected topics; this can include: forensic cartography, tactile maps, design with new technologies, perception and cognitive mapping, history of cartography, laboratory management.

GEOG 699 Seminar in Computer Cartography (3 credits)
Prerequisite: GEOG373; or students who have taken courses with comparable content may contact the department; or permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in computer-assisted cartography: algorithms for linear generalization, containing three-dimensional mapping and continuous-time mapping.

GEOG 718 Seminar in Integrative Studies (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics integrating various areas of study within the field of geography and/or related disciplines.

GEOG 732 Spatial Econometrics (3 credits)
Prerequisite: Permission of BSOS-Geography department. Or GEOG201; and GEOG306; and GEOG202; and GEOG332. Also offered as: GEOG432. Credit only granted for: GEOG498E, GEOG432, GEOG788E, GEOG732. Formerly: GEOG498E, GEOG788E.
An introduction to modern econometric techniques in general and spatial econometrics in particular, using the popular open source statistical computer language R. A focus on using statistical computing to produce analytical reports for real-world applications, research papers, and dissertations.

GEOG 738 Seminar in Human Geography (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in human geography.

GEOG 748 Seminar in Physical Geography (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in physical geography.

GEOG 749 Seminar in Biogeography (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in biogeography.

GEOG 777 Mobile GIS Development (3 credits)
Prerequisite: Permission of BSOS-Geography department; or must be enrolled in Geographical Sciences Phd or MS degree program. Restriction: Must be in a major within the BSOS-Geography department; or permission of BSOS-Geography department. Credit only granted for: GEOG477, GEOG498V, GEOG788V or GEOG777. Formerly: GEOG788V.
Designed as an introduction to mobile GIS, to the programming concepts underlying mobile GIS development, and more importantly, to the design and implementation of a mobile GIS application. Covers how to develop, test, and publish mobile GIS native apps working across two mobile platforms: Android and iOS. This course will also try to leverage the capabilities of JavaScript, Swift, Google maps, ArcGIS Server and runtime SDK to developing and publishing mobile GIS web apps.

GEOG 778 Seminar in Remote Sensing (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in remote sensing.

GEOG 779 Seminar in Geographic Information Science (3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 6 credits if content differs.
Selected topics in geographic information science.

GEOG 788 Selected Topics in Geography (1-3 credits)
Restriction: Permission of BSOS-Geography department. Repeatable to 12 credits if content differs.
Readings and discussion on selected topics in the field of geography.

GEOG 789 Independent Readings (1-3 credits)
Repeatable to 6 credits if content differs.
Independent reading as arranged between a graduate faculty member and graduate student.

GEOG 790 Internship in Geography (3 credits)
Field experience in the student's specialty in a Federal, state, or local agency or private business. Research paper required.

GEOG 792 Teaching Assistant Seminar (1 credits)
GEOG 792 - Guidance and instruction for incoming and future teaching assistants.

GEOG 793 Professional Project I (3 credits)
Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program. Credit only granted for: GEOG793 or GEOG797. Formerly: GEOG797.
Implementing and reporting GIS projects is one of required skills for professional GIS practitioners. The course will introduce the components, procedure and methods of implementing, reporting and managing a GIS project. Students will study published project reports to learn the methods for designing a GIS project. The final project will be a project design for their individual projects to be implemented in GEOG794, Professional Project II.

GEOG 795 Professional Practices Seminar (1 credits)
Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program.
Development and preparation of a resume, selecting and helping reference writers, conducting successful interviews, negotiating an employment package, giving professional presentations, proposal prepartion, writing reports, codes of ethics and responsibilities.
Presentations from practitioners in GIS field. Basic project management skills and strategies in preparation for professional project.

GEOG 796 GIS Project Management (3 credits)
Prerequisite: GEOG653, GEOG652, and GEOG606. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program; or must be in the Geospatial Information Sciences (Graduate Certificate) program. Credit only granted for: GEOG796 or INFM706. Formerly: INFM706.
Project management methodology is covered, emphasizing implementing and integrating GIS into broader projects. Topics include project initiation, planning, scope, scheduling, budgeting and risk management.

GEOG 797 Professional Project (3 credits)
Prerequisite: GEOG795; and must have completed or be concurrently enrolled in ENCE662. Restriction: Must be in M.Prof.Studies: Geospatial Information Sciences (Master's) program.
Data and materials can originate from an internship (internal or external) or from relevant work experience with current employer. Under direction of faculty advisor, students will prepare a project report containing explanation of the requirements for the work, technical account of the activities undertaken, including literature review, description of methods and approaches taken, a critical discussion of results, along with conclusions and recommendations developed from the project. Final project will consist of a full-fledged GIS application that is up and running and can be tested, providing potential employers with a portfolio demonstrating student's ability to manage and develop a GIS application in real world situations.

GEOG 798 Selected Topics in Geography: Seminar Series (1 credits)
Repeatable to 6 credits if content differs.
Readings and discussions on selected topics in the field of geography.

GEOG 799 Master's Thesis Research (1-6 credits)

GEOG 898 Pre-Candidacy Research (1-8 credits)

GEOG 899 Doctoral Dissertation Research (1-8 credits)

Geology (GEOL)

GEOL 412 Geology of the Terrestrial Planets (3 credits)
Prerequisite: GEOL341 or GEOL340. Credit only granted for: GEOL489A or GEOL412. Formerly: GEOL489A.
Geological features of Mercury, Venus, Mars and the Moon with an emphasis on results from recent NASA planetary mission. Topics include interior structure, impact cratering, tectonic and volcanic history, surface conditions, climate change, and habitability.

GEOL 423 Optical Mineralogy (4 credits)
Prerequisite: GEOL100 or GEOL120; and GEOL110; and GEOL322. And CHEM131 and CHEM132; or (CHEM135 and CHEM136); or CHEM103. Restriction: Non-degree-seeking students require the permission of the instructor.
The optical behavior of crystals with emphasis on the theory and application of the petrographic microscope.

GEOL 431 Vertebrate Paleobiology (4 credits)
Prerequisite: BSCI207, BSCI392, GEOL104, GEOL204, or GEOL331; or permission of CMNS-Geology department.
A survey of the evolution of the vertebrates, encompassing information from the diversity of living members, but concentrating on the contribution of the fossil record. Emphasis is on the phylogenetic systematics, comparative and functional anatomy, developmental biology, and stratigraphic distribution of major extinct and extant groups.

GEOL 435 Environmental Geochemistry (3 credits)
Prerequisite: MATH115; and (GEOL100 or GEOL120); and (GEOL436 or GEOL444). And CHEM131 and CHEM132; or (CHEM135 and CHEM136). Restriction: Nondegree-seeking students require the permission of the instructor. Credit only granted for: GEOL489W or GEOL435. Formerly: GEOL489W.
An understanding of geochemical cycles of Earth's surface systems including soils, rivers, lakes, and estuaries and causes and implications of alteration of geochemical cycles. Topics include chemical weathering, soils, chemical composition of inland waters, hydrologic tracers, salinization, eutrophication, nutrient and metal pollution, and global geochemical cycles.

GEOL 436 Principles of Biogeochemistry (3 credits)
Prerequisite: MATH140 or MATH220; and (GEOL100 or GEOL120); and GEOL322. And CHEM131 and CHEM132; or (CHEM135 and CHEM136). Restriction: Non-degree-seeking students require the permission of the instructor. Also offered as: AOSC436. Credit only granted for: GEOL436 or AOSC436.
An introduction to the basic principles of biogeochemistry including aspects of organic geochemistry, biochemistry, microbiology, global geochemical cycles, the origin of life and paleoenvironmental evolution.

GEOL 437 Global Climate Change: Past and Present (3 credits)
Prerequisite: MATH115 or MATH140; and (GEOL100 or GEOL120); and (CHEM131 or CHEM135); and (CHEM132 or CHEM136).
Introduction to the processes by which climate varies, the paleoclimate record, and projections of climate change into the 21st century, including discussion of climate sensitivity to external radiative forcing.

GEOL 443 Petrology (4 credits)
Prerequisite: GEOL322. And CHEM131 and CHEM132; or (CHEM135 and CHEM136); or CHEM103. And must have completed or be concurrently enrolled in GEOL423; and (GEOL100 or GEOL120); and GEOL110. Corequisite: Permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor.
Study of igneous and metamorphic rocks: petrogenesis, distributions, chemical and mineralogical relations, macroscopic and

microscopic descriptions, geologic significance.

GEOL 444 Low Temperature Geochemistry (4 credits)

Prerequisite: GEOL322, GEOL100, and MATH115. And CHEM103; or (CHEM131 and CHEM132); or (CHEM135 and CHEM136). Restriction: Non-degree-seeking students require the permission of the instructor.

Basic chemical principles, thermodynamics, and kinetics of low-temperature inorganic and organic geochemical reactions in a wide range of surface environments. These geochemical tools will be used to provide a context for understanding elemental cycling and climate change. Laboratories will include problem sets as well as wet chemical and mass spectrometric techniques used in low temperature geochemistry.

GEOL 445 High Temperature Geochemistry (4 credits)

Prerequisite: GEOL322, GEOL100, and MATH115. And CHEM131 and CHEM132; or (CHEM135 and CHEM136); or CHEM103. Restriction: Non-degree-seeking students require the permission of the instructor.

Review of chemical principles and their use in understanding processes of Earth, and solar system formation and differentiation. Topics include nucleosynthesis and cosmochemical abundances of elements, bonding and element partitioning, equilibrium thermodynamics and phase stabilities, radiogenic isotopes and geochronology, kinetics, and diffusion.

GEOL 446 Geophysics (3 credits)

Prerequisite: PHYS141, MATH141, and MATH140; and (GEOL100 or GEOL120). Restriction: Non-degree-seeking students require the permission of the instructor.

An introduction to modern geophysics. Topics include: global plate tectonics, plate motion, triple junctions, geomagnetism, earthquakes and faulting, reflection and refraction seismology, gravity and isostasy, heat flow and mantle dynamics, deep interior of the Earth, geophysical observations and measurements.

GEOL 447 Observational Geophysics (3 credits)

Prerequisite: MATH140 and MATH141; and (PHYS141, PHYS161, or PHYS171).

An introduction to practical signal processing, data analysis, and inverse theory in geophysics.

GEOL 451 Groundwater (3 credits)

Prerequisite: GEOL110 and MATH140; and (GEOL120 or GEOL100); and (CHEM131 and CHEM132; or (CHEM135 and CHEM136); or CHEM103). Or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor; and junior standing or higher.

An introduction to the basic geologic parameters associated with the hydrologic cycle. Problems in the accumulation, distribution, and movement of groundwater will be analyzed.

GEOL 452 Watershed and Wetland Hydrology (3 credits)

Prerequisite: Permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor; and junior standing or higher.

Physical processes by which water moves in watershed and wetland systems. Topics include: precipitation, infiltration, flow in the unsaturated zone, streamflow generation processes, and groundwater flow.

GEOL 453 Ecosystem Restoration (3 credits)

Prerequisite: MATH220 or MATH140; and (CHEM131 or CHEM135); and (CHEM132 or CHEM136); and (GEOL100, GEOL120, or ENST200). Restriction: Junior standing or higher; and permission of instructor is required of non-degree-seeking students. Credit only granted for: GEOL453 or GEOL489L. Formerly: GEOL489L.

Overview of ecosystem functions across biomes/geologic settings, and considerations and tradeoffs in ecosystem restoration strategies. Specific case studies and discussions will be aimed at understanding how structure can influence biophysical and biogeochemical processes supporting ecosystems, and then describes how rates, timing, and location of physical, chemical, and ecosystem processes can be altered by different restoration strategies to enhance ecosystem services.

GEOL 455 Marine Geophysics (3 credits)

Prerequisite: MATH141 and MATH140; and (GEOL120 or GEOL100). Or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL455 or GEOL489E. Formerly: GEOL489E.

Plate tectonics, earthquakes and faulting, isostasy and gravity, heat and mantle dynamics, ocean ridges and transform faults, hydrothermal vents, trenches and oceanic islands, subduction zones, accretionary and erosion wedges, sedimentary basins and continental rifts. Exploration of the oceans using geophysical methods.

GEOL 456 Engineering Geology (3 credits)

Prerequisite: PHYS141 and MATH141; and (GEOL120 or GEOL100). Or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL456 or GEOL489Z. Formerly: GEOL489Z.

An overview of engineering geology with an emphasis on physical understanding of natural hazards and natural resources. General theories of stress and strain, failure criteria, frictional stability, fluid flow in porous media and poroelasticity are introduced. Quantitative approaches on earthquakes, landslides, land subsidence, and geotechnical aspects of oil/gas exploration are discussed.

GEOL 457 Seismology (3 credits)

Prerequisite: GEOL120 or GEOL100; and (MATH141, GEOL110, and MATH140). Or permission of CMNS-Geology department. Recommended: PHYS171, PHYS141, or PHYS161. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL457 or GEOL489A. Formerly: GEOL489A.

General overview of the basics of seismology, starting with wave propagation, seismic reflection and refraction. Applications to the determination of the seismic velocity and anisotropy structure of the Earth. Earthquake generation, postseismic deformation and creep events, relation to faulting and plate tectonics.

GEOL 460 Field Geophysics (4 credits)

Prerequisite: MATH140, MATH141, and GEOL446; and (PHYS141, PHYS161, or PHYS171). Restriction: Non-degree-seeking students require the permission of the instructor.

Students will become familiar with geophysical instrumentation used for both scientific and industrial applications. Students will be given an introduction to the use of geophysical instrumentation for data collection, processing, and analysis, design of field experiments for investigating field geophysical problems, and an introduction to the theory of instrument design and use. Instruments that will be covered include (but are not limited to): broadband seismometers, geophones, ground-penetrating radar, magnetotellurics, and Global Positioning Satellites.

GEOL 463 Economic Geology (3 credits)

Prerequisite: GEOL322; and (CHEM131 or CHEM135); and (CHEM132 or CHEM136). Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL489Q or

GEOL463. Formerly: GEOL489Q.
The geological setting, and mineralogy of ore bodies, as well as the chemical and physical factors affecting the source, transport and deposition of metallic ores, petroleum and natural gas will be covered. The economics of mineral resources will be discussed.

GEOL 471 Geochemical Methods of Analysis (3 credits)
Prerequisite: CHEM131 and CHEM132; or (CHEM135 and CHEM136); or CHEM103. Restriction: Non-degree-seeking students require the permission of the instructor.
Principles and application of geochemical analysis as applied to a variety of geological problems. X-ray and optical spectroscopy, X-ray diffraction, atomic absorption, electron microprobe, and electron microscopy.

GEOL 472 Tectonics (3 credits)
Prerequisite: GEOL120 or GEOL100; and (GEOL102, GEOL341, and GEOL110). Or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor.
Study of the development of the lithosphere on Earth and other rocky planets and moons. Emphasis on student-led discussions. Improvement of scientific writing.

GEOL 473 Origin and Evolution of the Continents (3 credits)
Prerequisite: GEOL445 and GEOL443; or permission of instructor. Restriction: Non-degree-seeking students require the permission of the instructor. Formerly: GEOL489I.
Introduction to current theories regarding the origin and evolution of the continents. Emphasis on development of critical reading and reasoning skills, and improvement of verbal and written communication.

GEOL 489 Special Topics (3 credits)
Prerequisite: Must have completed at least 2 upper-level GEOL courses plus one additional GEOL course. Corequisite: GEOL393. Restriction: Must be in Geology program; and junior standing or higher.
Recent advances in geology.

GEOL 490 Geology Field Camp (6 credits)
Prerequisite: GEOL341 and GEOL443. Restriction: Non-degree-seeking students require the permission of the instructor.
Intense field geology course taught off campus during the summer. Students describe and compile maps of formations and structures from outcrops, subsurface, and remotely sensed data. Special fees required.

GEOL 491 Environmental Geology Field Camp (3-6 credits)
Prerequisite: GEOL341, GEOL342, and GEOL451; or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL490 or GEOL491.
Intensive field course designed for students of environmental geology. Students will learn to make maps, to describe soil profiles and site characteristics, to monitor hydrologic and groundwater conditions, and to measure geologic structures and stratigraphic sections.

GEOL 497 Recent Advances: Geology (3 credits)
Prerequisite: Must have completed at least 2 upper-level GEOL courses. Corequisite: GEOL393; and a third upper-level geology course. Restriction: Must be in Geology program; and GPA of 3.0 or better in both overall and in all courses required for the major; and senior standing; and to be taken as late as possible in the program. Credit only granted for: GEOL497 or GEOL489H. Formerly: GEOL489H.
A survey of important recent advances in geological sciences in the context of the methods and practices of scientific research.

GEOL 499 Special Problems in Geology (1-3 credits)
Prerequisite: (GEOL120 or GEOL100; and (GEOL102 and GEOL110)); or students who have taken courses with comparable content may contact the department. And permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor.
Intensive study of a special geologic subject or technique selected after consultation with instructor. Intended to provide training or instruction not available in other courses which will aid the student's development in his or her field of major interest.

GEOL 612 Geology and Geophysics of the Terrestrial Planets (3 credits)
Prerequisite: Permission of CMNS-Geology department; or (GEOL446 and MATH141). Recommended: Familiarity with MATLAB or MATHEMATICA. Credit only granted for: GEOL680 or GEOL789A. Formerly: GEOL789A.
Geological features of Mercury, Venus, Mars and the Moon with an emphasis on results from recent NASA planetary mission. Class is organized to follow geological processes or observation throughout the inner solar system. Topics covered include interior structure, impact cratering, tectonic and volcanic history, surface conditions and climate change.

GEOL 614 Thermodynamics of Geological Processes (3 credits)
Prerequisite: PHYS142, GEOL322, and MATH141; and must have completed CHEM113. Restriction: Non-degree-seeking students require the permission of the instructor.
Thermodynamics and its application to problems in mineralogy, petrology and geochemistry. Systematic development of the laws of thermodynamics and the principles of chemical equilibrium as applied to geological problems.

GEOL 621 Mineralogy of Ore-Forming Sulfides (3 credits)
Prerequisite: GEOL322; or students who have taken courses with comparable content may contact the department. Restriction: Non-degree-seeking students require the permission of the instructor.
A systematic study of chemical compositions, crystal structures, and paragenetic relations of major ore-forming sulfides.

GEOL 622 Mineralogy of the Rock-Forming Silicates (3 credits)
Prerequisite: CHEM481; or students who have taken courses with comparable content may contact the department. Restriction: Non-degree-seeking students require the permission of the instructor.
A systematic study of the structure, polymorphic relations, composition and phase transformations of the major rock forming silicates.

GEOL 623 Ore Microscopy (3 credits)
Prerequisite: GEOL423; and must have completed or be concurrently enrolled in GEOL653. Restriction: Non-degree-seeking students require the permission of the instructor.
A systematic study of general principles of reflected light optics and their application to the reflected light polarizing microscope as well as techniques for identifying common ore mineral in polished section.

GEOL 635 Environmental Geochemistry (3 credits)
Prerequisite: MATH115; and (GEOL100 or GEOL120); and (GEOL436 or GEOL444). And CHEM131 and CHEM132; or (CHEM135 and CHEM136). Restriction: Nondegree-seeking students require the permission of the instructor. Also offered as: GEOL435. Credit only granted for: GEOL635, GEOL789W, GEOL435 or GEOL489W. Formerly: GEOL789W.
Geochemical cycles of Earth's surface systems including soils, rivers, lakes, and estuaries and causes; and implications of

their alteration. Topics include chemical weathering, soils, chemistry of inland waters, hydrologic tracers, salinization, eutrophication, nutrient and metal pollution, and global geochemical cycles.

GEOL 641 Advanced Structural Geology (3 credits)
Restriction: Non-degree-seeking students require the permission of the instructor.
A detailed treatment of stress, strain, deformation of rocks, and resulting structures on microscopic, mesoscopic, and macroscopic scales; consideration of world examples of structural variation; concept and problems of plate tectonics; all designed as a complete study of structural geology.

GEOL 643 Igneous and Metamorphic Petrology (3 credits)
Prerequisite: GEOL443. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL643 and GEOL789P. Formerly: GEOL789P.
Study of igneous and metamorphic rocks; environments, conditions and processes of metamorphism and of melting and crystallization.

GEOL 644 Metamorphic Petrology (3 credits)
Prerequisite: GEOL443 and CHEM481. Restriction: Non-degree-seeking students require the permission of the instructor.
Analysis of the physical and chemical aspects of metamorphic processes. Suites of metamorphic rocks by the use of chemical, mineralogic, petrographic, and field data.

GEOL 646 Crustal Petrology (3 credits)
Prerequisite: GEOL643 or GEOL644; or permission of instructor. Recommended: GEOL641. Restriction: Non-degree seeking students require the permission of the department.
An integrated approach to the detailed understanding of the petrology of the earth's continental crust and the processes which act upon it and within it.

GEOL 647 Observational Geophysics (3 credits)
Prerequisite: MATH140, MATH141, and PHYS141; and (PHYS161 or PHYS171). Credit only granted for: GEOL789O or GEOL647. Formerly: GEOL789O.
Introduces graduate students to instrument design and performance, signal processing, data analysis and inverse theory in geophysics.

GEOL 650 Isotope and Trace Element Geochemistry (3 credits)
Prerequisite: GEOL443; or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor.
Trace elements and isotopes in geology, including modern applications in geochronology and petrogenesis.

GEOL 651 Statistics for Geoscientists (3 credits)
Prerequisite: MATH115; and non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL789V or GEOL651. Formerly: GEOL789V.
Practical approach to basic statistics applied in the geosciences. Experimental design, elementary statistics and probability, sequence analysis, spatial analysis, linear regression, nonparametric statistics, bivariate, multivariate and principal components analysis of variance, hypothesis testing. Problem sets and participatory discussion of statistical applications in the current literature.

GEOL 652 Advanced Watershed and Wetland Hydrology (3 credits)
Prerequisite: GEOL452; or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor.
Physical and chemical processes in watershed and wetland systems: with an emphasis on redox reactions.

GEOL 653 Advanced Problems in Economic Geology (3 credits)
Prerequisite: GEOL453. Restriction: Non-degree-seeking students require the permission of the instructor.
A systematic study of particular ore deposit types or areas of mineralization, primarily involving major economically important metals. Geologic setting, mineralogy and form and character of the ore bodies, chemical and physical factors affecting source, transport and deposition of ore forming fluids.

GEOL 654 Fluvial Geomorphology Seminar (3 credits)
Recommended: GEOL452 and GEOL340. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL654 or GEOL789B. Formerly: GEOL789B.
Fluvial geomorphology is the study of the movement of water and sedimentin stream channels. This includes: formation of channels, open channel hydraulics, sediment transport or bedload and suspended load, river morphology and landscape evolution. The course is designed for graduate students and advanced undergraduates.

GEOL 655 Marine Geophysics (3 credits)
Prerequisite: Permission of CMNS-Geology department. Recommended: GEOL120 or GEOL100; and MATH141. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL655 or GEOL789E. Formerly: GEOL789E.
An introduction to geophysical aspects of global tectonics. Quantitative geophysical approached are introduced for: past and present plate motions, seismology and interior of the Earth, gravity and isostasy, heat and mantle dynamics. Ocean ridges, hydrothermal vents, transform faults, oceanic core complex, ocean trenches and subduction zones, accretionary anderosion wedges, rift and rift margins, convergence and collisons, sedimentary basins.

GEOL 656 Engineering and Environmental Geology (3 credits)
Prerequisite: GEOL100, GEOL110, MATH141, and PHYS141; or permission of instructor. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL656 or GEOL789Z. Formerly: GEOL789Z.
An overview of mechanical aspects of earthquakes as a result of fault instability. Quantitative approaches on soil and rock strength, instability on earthquakes, landslides, land subsidence, and geotechnical aspects of oil/gas exploration are discussed. Emphasis is on theoretical framework of mechanics of earthquake and faulting, earthquake source mechanisms, earthquake scaling relations, the seismic cycle etc.

GEOL 657 Seismic Wave Propagation (3 credits)
Prerequisite: MATH140 and MATH141; and (PHYS141, PHYS161, or PHYS171); and permission of CMNS-Geology department. Recommended: GEOL100 or GEOL120; and (MATH241 and MATH246); and (PHYS260 or PHYS273). Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL657 or GEOL789A. Formerly: GEOL789A.
A description of the physics of seismic wave propagation and their applications to the determination of the structure of the Earth and the mechanics of earthquakes.

GEOL 670 Physical Oceanography (3 credits)
Prerequisite: Permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor. Also

offered as: AOSC420, AOSC670. Credit only granted for: GEOL670, AOSC670 or AOSC420.
Ocean observations. Water masses, sources of deep water. Mass, heat, and salt transport, geochemical tracers. Western boundary currents, maintenance of the termocline. Coastal and estuarine processes. Surface waves and tides. Ocean climate.

GEOL 671 Analytical Methods in Mineralogy (3 credits)
Prerequisite: CHEM471. Restriction: Non-degree-seeking students require the permission of the instructor.
An intensive study in the operation and application of instrumentation in mineralogical problems. Emphasis on designing and testing methods of analysis for use in the student's research problems in geology.

GEOL 672 Tectonics (3 credits)
Prerequisite: GEOL341; or permission of CMNS-Geology department. Restriction: Non-degree-seeking students require the permission of the instructor. Credit only granted for: GEOL672 or GEOL789C. Formerly: GEOL789C.
The study of the development of the lithosphere on Earth and other rocky planets and moons. Emphasis on the student led discussion and improvement of scientific writing.

GEOL 680 Geodynamics (3 credits)
Prerequisite: Permission of CMNS-Geology department; or (MATH241, MATH462, and GEOL446). Recommended: Familiarity with MATLAB or MATHEMATICA. Credit only granted for: GEOL680 or GEOL789J. Formerly: GEOL789J.
The mechanics and dynamics of the Earth's interior and their applications to problems of Geophysics. This course considers several rheological descriptions of Earth materials (brittle, elastic, linear and nonlinear fluids, and viscoelastic) and emphasizes analytical solutions to simplified problem.

GEOL 681 Physics of Planetary Interiors and Surfaces (3 credits)
Prerequisite: Advanced undergraduate geophysics, astronomy or geochemistry; and GEOL446. Or permission of CMNS-Geology department. Credit only granted for: GEOL681 or GEOL789X. Formerly: GEOL789X.
Formation of planets in the solar system; segregation and core formation in terrestrial planets; formation of early atmosphere; tectonics and volcanism; geochemical and cosmochemical constraints; planetary geomorphology.

GEOL 690 Geoscience Communications (3 credits)
Credit only granted for: GEOL690, GEOL789R, or GEOL789S. Formerly: GEOL789R and GEOL789S.
Explores the style and logic of scientific writing including abstracts, articles, and proposals, as well as the preparation of clear and concise presentations, in order to enhance the quality of scientific communication and hasten the pace of successful publications.

GEOL 789 Recent Advances in Geology (2-4 credits)
Recent advances in geology research.

GEOL 798 Seminar in Geology (1-3 credits)
Repeatable to 9 credits if content differs.
Discussion of special topics in current literature in all phases of geology.

GEOL 799 Master's Thesis Research (1-6 credits)

GEOL 898 Pre-Candidacy Research (1-8 credits)

GEOL 899 Doctoral Dissertation Research (1-8 credits)

Germanic Studies (GERM)

GERM 401 Advanced Conversation (3 credits)
Prerequisite: GERM302; or students who have taken courses with comparable content may contact the department.
Development of fluency in spoken German to achieve advanced level.

GERM 403 Advanced Composition (3 credits)
Prerequisite: GERM302; or students who have taken courses with comparable content may contact the department.
Advanced instruction in and acquisition of German writing skills.

GERM 405 Stylistics (3 credits)
Prerequisite: GERM302; or students who have taken courses with comparable content may contact the department.
Stylistic analysis of oral and written German both literary and non-literary. Intensive study of vocabulary and syntax. Dictionary and composition exercises.

GERM 415 German/English Translation I (3 credits)
Restriction: Must not have completed GERM101, GERM102, GERM103, GERM201, GERM202, GERM203, GERM204, GERM301, or GERM302.
An intensive presentation of German grammar limited exclusively to reading skill; graded readings in the arts and sciences. Instruction in English; cannot be used to satisfy the arts and humanities foreign language requirement.

GERM 416 German/English Translation II (3 credits)
Prerequisite: GERM415; or students who have taken courses with comparable content may contact the department.
Written translation of materials from the student's field of study. Discussion of basic problems of German-to-English translation, with examples from students' projects. Instruction in English. Cannot be used to satisfy the arts and humanities foreign language requirement.

GERM 419 Selected Topics in German Language Study (3 credits)
Prerequisite: GERM302; and permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.

GERM 423 From Enlightenment through Storm and Stress (3 credits)
Prerequisite: GERM320, GERM321, or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Readings of representative authors from the Enlightenment (1720- 1785), the Age of Sentimentalism (1740-1780), and Storm and Stress (1767-1785). Taught in German.

GERM 431 Romanticism and Biedermeier (3 credits)
Prerequisite: GERM320, GERM321, or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Readings of representative authors from the periods of Romanticism (1798-1835) and Biedermeier (1820-1850). Taught in German.

GERM 432 Junges Deutschland and Realism (3 credits)
Prerequisite: GERM320, GERM321, or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Readings of representative authors from the periods of Junges Deutschland (1830-1850) and Realism (1850-1890). Taught in German.

GERM 433 Naturalism and Its Counter Currents (3 credits)
Prerequisite: GERM320, GERM321, or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Readings of representative authors from the period of naturalism and its counter currents (1880-1920). Taught in German.

GERM 434 Expressionism to 1945 (3 credits)
Prerequisite: GERM320; or GERM321; or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Readings of representative authors from Expressionism through the period between the wars to the contrast of Nazi and Exile Literature (ca. 1910-1945). Taught in German.

GERM 435 From 1945 to the Present (3 credits)
Prerequisite: GERM320; or GERM321; or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Readings of representative authors from Germany, Austria, and Switzerland in the period from the end of World War II to the present. Taught in German.

GERM 436 The Usual Suspects: Criminals in German Literature and Film (3 credits)
Prerequisite: GERM320 or GERM322; or permission of instructor.
An examination of how historical, cultural and political discourses in German-speaking countries influence social norms and criteria for judging what is considered socially acceptable or "deviant". Texts and films span from the 18th to 21st centuries. Taught in German.

GERM 439 Selected Topics in German Literature (3 credits)
Prerequisite: GERM320, GERM321, or GERM322; or permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Special study of an author, school, genre, or theme. Taught in German.

GERM 449 Selected Topics in Germanic Studies (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Study of a linguistic, literary or cultural topic in Yiddish, Netherlandic, or Scandinavian studies.

GERM 461 Reading Swedish, Danish and Norwegian I (3 credits)
Develops reading facility in three languages in one semester, using modern Scandinavian texts from a variety of fields.

GERM 463 The World of the Viking Sagas (3 credits)
An in-depth analysis of the Old Norse/Viking sagas of Medieval Scandinavia as literature historiography and folklore. Readings include Sagas of the Icelanders, Kings Sagas and Heroic/Mythical Sagas. Taught in English.

GERM 472 Introduction to Germanic Philology (3 credits)
Prerequisite: GERM202; or students who have taken courses with comparable content may contact the department.
Reconstructed proto-Germanic and surveys of Gothic, Old Norse, Old English, Old Saxon. The development of High German from the Old High German period through Middle High German to modern German; a short introduction to modern German dialectology. Taught in English.

GERM 473 Variation in Contemporary German Language (3 credits)
Prerequisite: GERM302; or permission of instructor. Also offered as: GERM673. Credit only granted for: GERM473, GERM489M, or GERM673. Formerly: GERM489M.
Examines the unique, multilingual society that is modern Germany, exploring issues such as regional varieties, gendered language, language reform (and resistance to it), public and media speech, the influence of American English on colloquial speech and in specific fields, and the problems of immigrant communities acquiring both dialect and standard German.

GERM 475 Old Norse (3 credits)
The language of the old Icelandic saga, the Eddas and Skaldic poetry. Reading of texts in the original; historical development of Old Norse and its role in the Germanic language family. No knowledge of German or a Scandinavian language required. Taught in English.

GERM 479 Selected Topics in Germanic Philology (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Selected topics such as comparative Germanic studies, Old Norse language or readings in Old Norse literature, modern German dialectology.

GERM 489 Selected Topics in Area Studies (1-3 credits)
Prerequisite: GERM302; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.

GERM 498 Honors Thesis Writing (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Required for students pursuing departmental honors in Germanic languages and literatures. Under the direction of a German department faculty member, students write their honors theses.

GERM 499 Directed Study (1-3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.

GERM 601 The Structure of German (3 credits)
Prerequisite: Must have advanced knowledge of German.
An introduction to the phonetics and phonology of Modern German. Contrasting analysis of the sound systems of German and English. Tools and techniques for teaching the pronunciation of German.

GERM 618 College Teaching of German (1 credits)
Repeatable to 3 credits. Formerly: GERM611.
Instruction, demonstration and classroom practice under supervision of modern procedures in the presentation of elementary German courses to college age students.

GERM 620 Methods of German Literary Studies I: Theory (3 credits)
History, methods and concepts of German literary studies. The teaching modules include a general introduction to "Germanistik," an in-depth discussion of literary theory and criticism, and the typology of genres.

GERM 630 Methods of German Literary Studies II: Practical Application (3 credits)
Prerequisite: GERM620; or permission of instructor.
Application of various theoretical approaches to German literary studies introduced in GERM 620.

GERM 631 German Lyric Poetry (3 credits)
An exposition of the genre of lyric poetry, its metrical and aesthetic background, illustrated by characteristic examples from the Middle Ages to the present.

GERM 632 The German Novelle (3 credits)
Study of the development of the genre from the 18th century to the present.

GERM 633 The German Novel (3 credits)
The theory and structure of the German novel from the Baroque to the present.

GERM 634 German Drama (3 credits)
An introduction to the theory and structure of the German drama from the Baroque to the present with extensive interpretation of characteristic works.

GERM 673 Variation in Contemporary German (3 credits)
Also offered as: GERM473. Credit only granted for: GERM489L, GERM673, or GERM689L.
Examines the unique, multilingual society that is modern Germany, exploring issues such as regional varieties, gendered language, language reform (and resistance to it), public and media speech, the influence of American English on colloquial speech and in specific fields, and the problems of immigrant communities acquiring both dialect and standard German. This may count for the upper-division requirement of the German major.

GERM 689 Special Topics - M.A. Level (1-3 credits)
Repeatable to 6 credits if content differs.
M.A.-level study of a literary, linguistic or cultural topic in German or Germanic studies.

GERM 798 Master's Independent Study (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

GERM 799 Master's Thesis Research (1-6 credits)

GERM 818 Seminar: The Middle Ages (3 credits)
Repeatable to 9 credits if content differs.
Study of one or more representative authors or works of the Middle Ages.

GERM 819 Seminar: The 16th and 17th Centuries (3 credits)
Repeatable to 9 credits if content differs.
The German literature of the Humanists, the Reformation and the Baroque as illustrated by study of one or more authors of the 16th or 17th centuries.

GERM 828 Seminar: The 18th Century (3 credits)
Repeatable to 9 credits if content differs.
Study of one or more authors from the Enlightenment, Sentimentalism, Stress, or Classicism periods.

GERM 829 Seminar: The 19th Century (3 credits)
Repeatable to 9 credits if content differs.
Study of one or more authors of Romanticism, Biedermeier, Young Germany or Realism.

GERM 838 Seminar: The 20th Century (3 credits)
Repeatable to 9 credits if content differs.
Study of a literary movement or of one or more authors from the period of Naturalism to the present.

GERM 839 Seminar: Special Topics (3 credits)
Repeatable to 9 credits if content differs.
Study of a topic of a general nature and not limited to any specific century.

GERM 879 Seminar in Germanic Philology (3 credits)
Repeatable to 9 credits if content differs.
In depth study of a topic in Germanic or Indo-European philology comparative Germanic grammar, runology, dialect geography, Eddic or Skaldic poetry, Indo-European studies.

GERM 888 Doctoral Independent Study (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

GERM 889 Seminar in Germanic Area Studies (3 credits)
Repeatable to 9 credits if content differs.
Comprehensive study of a selected topic in German or Germanic area studies: history of ideas, cultural history, Germanic literatures other than German, folk literature and folklore.

GERM 898 Pre-Candidacy Research (1-8 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

GERM 899 Doctoral Dissertation Research (1-8 credits)

Greek (GREK)

GREK 403 Greek Tragedy (3 credits)

GREK 411 Modern Greek Literature and History (3 credits)
Prerequisite: Students must have earned a grade of C- or better in a 300-level Modern Greek course. Restriction: Permission of instructor. Credit only granted for: GREK311 or GREK411. Formerly: GREK311.
Students will study historical and political events in Greece during the 19th and 20th centuries through the viewpoint of the man of letters. Poetry, prose, plays, and essays reflect national emancipation, social reconstruction, and political struggles. Readings and discussion are in Modern Greek.

GREK 415 Homer (3 credits)
Prerequisite: Permission of ARHU-Classics department.
Extensive readings in Greek from the Iliad or the Odyssey, with special attention to the features of Homeric style and the relationship between the two epics.

GREK 472 History and Development of the Greek Language (3 credits)
Restriction: Permission of instructor.
Mastery of ancient Greek through grammar review, prose composition, and analysis of historical developments in Greek writers' modes of expression.

GREK 488 Greek Readings (3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.
The reading of one or more selected Greek authors. Reports.

GREK 499 Independent Study in Greek Language and Literature (1-3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.

GREK 603 Greek Tragedy (3 credits)
The reading of two tragedies of the Athenian tragedians. Detailed discussion of historical background, literary art, thought, and the circumstances and manner of their production. Other tragedies will be read in English.

GREK 604 Homer (3 credits)
The extensive and intensive reading of Homer, with concentration on one of his two epics. Discussion of the language,

artistic qualities, and thought of the poems, and of modern views concerning their orgin and literary qualities.

GREK 606 Greek Historians (3 credits)
Survey of the Greek historians, concentrating on Herodotus and Thucydides, contrasting the two historians in the areas of subject, methods of research, composition, and achievement.

GREK 672 History and Development of the Greek Language (3 credits)
Restriction: Permission of instructor.
Mastery of ancient Greek through grammar review, prose composition, and analysis of historical developments in Greek writers' modes of expression.

GREK 688 Special Topics in Greek Literature (3 credits)
Repeatable to 9 credits if content differs.

GREK 699 Independent Study in Greek Literature (1-3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.

GREK 799 Master's Thesis Research (1-6 credits)

Government and Politics (GVPT)

GVPT 402 International Law (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program; and junior standing or higher.
A study of the basic character, general principles and specific rules of international law, with emphasis on recent and contemporary trends in the field and its relation to other aspects of international affairs.

GVPT 404 Private International Law (3 credits)
Prerequisite: GVPT200. Recommended: GVPT402. Restriction: Must be in Government & Politics program; and junior standing or higher.
An introduction to private international law, defined as those substantive laws that a nation or nations have applied to private transactions involving transnational relationships. Private international law is often called the "conflict of laws" because it almost always arises to deal with the existence of a number of separate legal systems in the various states, each practicing their own 'municipal law' in ways that invariably raise real and potential conflicts requiring accommodation and cooperation.

GVPT 406 International Organizations (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program; and junior standing or higher.
A basic introduction to the full range of international organizations that have come into being over the past century and one-half, including those that aspire to be universal or global, those with a geopolitical or regional focus, and those that address specific structural or functional areas of human endeavor or issue areas.

GVPT 407 International Political Economy (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program; and junior standing or higher.
Introduces the field of international political economy, which analyzes the ways in which economic and political changes produce both economic and political reactions.

GVPT 409 Seminar in International Relations and World Politics (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program; and junior standing or higher. Repeatable to 6 credits if content differs.
Reading, writing, and research on topics in international relations and world politics. Both substantive issues and methodological approaches will be considered.

GVPT 417 Seminar in Advanced Topics in Environmental Policy Analysis (3 credits)
Prerequisite: GVPT273. Restriction: Must be in one of the following programs (Government & Politics; Environmental Sci&Policy-Env Politics & Policy). Credit only granted for: GVPT419B or GVPT417. Formerly: GVPT419B.
A series of critical tools and methods used to analyze environmental policy. This class should be of interest to students who are either considering a career or graduate studies in environmental protection.

GVPT 419 Seminar in Public Policy (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT270. Restriction: Must be in Government & Politics program. Repeatable to 6 credits if content differs.
Reading, writing, and research on topics in public policy. Both substantive issues and methodological approaches will be considered.

GVPT 422 Quantitative Political Analysis (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT220. Restriction: Must be in Government & Politics program. Credit only granted for: BIOM301, BMGT230, CCJS200, ECON230, ECON321, EDMS451, GEOG306, GEOL351, GVPT422, PSYC200 or SOCY201.
Introduction to quantitative methods of data analysis, including selected statistical methods, block analysis, content analysis, and scale construction.

GVPT 423 Elections and Electoral Behavior (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program.
An examination of various topics relating to elections; the focus includes the legal structure under which elections are conducted, the selection and nomination process, the conduct of election campaigns, and patterns of political participation and voting choice in different types of elections.

GVPT 424 Topics in Formal Theories of Political Behavior and Politics (3 credits)
Prerequisite: GVPT241 and GVPT221. Restriction: Must be in a major within BSOS-Government & Politics department.
The focus of this course will vary both by its theoretical core and its applications. The theories are likely to be those of games, social choice, and voting. The applications will usually be to problems of distributive and social justice, community organizing, responsive public policy, institutional design, alliance and coalition formation, etc. Some of the topics will involve research projects.

GVPT 426 Public Opinion (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT220. Restriction: Must be in Government & Politics program; and junior standing or higher.
An examination of public opinion and its effect on political action, with emphasis on opinion formation and measurement, propaganda and pressure groups.

GVPT 427 Political Sociology (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT220. Restriction: Must be in Government & Politics program.
A study of the societal aspects of political life including selected aspects of the sociology of group formation and group dynamics, political association, community integration, and political behavior.

GVPT 428 Topics in Formal Theories of Political Behavior and Politics (3 credits)
Prerequisite: GVPT241 and GVPT221. Restriction: Must be in Government & Politics program. Repeatable to 6 credits if content differs.
An evaluation of theories of political behavior such as game, social choice and voting theory, and their applications to problems of distribution and social justice, community organizing, responsive public policy, institutional design, and alliance and coalition formation.

GVPT 429 Problems in Political Behavior (3 credits)
Prerequisite: GVPT241. Recommended: GVPT220. Restriction: Must be in Government & Politics program.
The problem approach to political behavior with emphasis on theoretical and empirical studies on selected aspects of the political process.

GVPT 431 Introduction to Constitutional Law (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program; and junior standing or higher.
A systematic inquiry into the general principles of the American constitutional system, with special reference to the role of the judiciary in the interpretation and enforcement of the federal constitution.

GVPT 432 Civil Rights and the Constitution (3 credits)
Prerequisite: GVPT241 and GVPT331. Restriction: Must be in Government & Politics program.
A study of civil rights in the American constitutional context, emphasizing freedom of religion, freedom of expression, minority discrimination, and the rights of defendants.

GVPT 433 The Judicial Process (3 credits)
Prerequisite: GVPT241 and GVPT331. Restriction: Must be in Government & Politics program.
An examination of judicial organization in the United States at all levels of government, with some emphasis on legal reasoning, legal research, and court procedures.

GVPT 439 Seminar in Public Law (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT331. Restriction: Must be in Government & Politics program; and junior standing or higher. Repeatable to 6 credits if content differs.
Reading, writing, and research on topics in public law. Both substantive issues and methodological approaches will be considered.

GVPT 441 History of Political Theory: Ancient and Medieval (3 credits)
Prerequisite: GVPT241. Restriction: Must be in Government & Politics program; and junior standing or higher.
A survey of the principal political theories set forth in the works of writers before Machiavelli.

GVPT 442 History of Political Theory--Medieval to Recent (3 credits)
Prerequisite: GVPT241. Restriction: Must be in Government & Politics program.
A survey of the principal theories set forth in the works of writers from Machiavelli to Nietzsche.

GVPT 443 Contemporary Political Theory (3 credits)
Prerequisite: GVPT241. Restriction: Must be in Government & Politics program.
A survey of the principal political theories and ideologies set forth in the works of writers from Karl Marx to the present.

GVPT 444 American Political Theory (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must not be in Government & Politics program.
A study of the development and growth of American political concepts from the Colonial period to the present.

GVPT 445 Marxism and Postmarxism (3 credits)
Restriction: Must be in a major within BSOS-Government & Politics department.
The study of Marxist thought and an assessment of the critical transformations and reassessments of the theory and practice of Marxism.

GVPT 448 Non-Western Political Thought (3 credits)
Prerequisite: GVPT241. Restriction: Must be in Government & Politics program. Additional information: Permission of department required for repeat.
Examination of works by major authors and general themes of political thought originating in Asia, the Middle East, and Africa. This is not a survey of all non-Western political thought, but a course to be limited by the professor with each offering.

GVPT 449 Seminar in Political Philosophy (3 credits)
Prerequisite: GVPT241. Restriction: Must be in Government & Politics program. Repeatable to 6 credits if content differs.
Reading, writing, and research on topics in political philosophy. Both substantive issues and methodological approaches will be considered.

GVPT 454 Seminar in the International Relations of China (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program; and junior standing or higher.
Explores the foreign relations behavior of the People's Republic of China, with focus on the contemporary era.

GVPT 455 Contemporary Middle Eastern Politics (3 credits)
Prerequisite: GVPT200; and (GVPT282 or GVPT280). Restriction: Must be in Government & Politics program.
A survey of contemporary development in the international politics of the Middle East nations in the world affairs.

GVPT 456 The Politics of Terrorism (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program. Credit only granted for: GVPT456 or GVPT459T. Formerly: GVPT459T.
Examination of the definition, causes and organization of terrorist activity, along with key domestic and international counter- and anti-terrorism responses. Special emphasis on challanges and opportunities to the scientific study of terrorism.

GVPT 457 American Foreign Relations (3 credits)
Prerequisite: GVPT200. Restriction: Must be in Government & Politics program; and junior standing or higher.
The principles and machinery of the conduct of American foreign relations, with emphasis on the Departments of State and Defense, and an analysis of the major foreign policies of the United States.

GVPT 458 Special Topics in Study Abroad IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

GVPT 459 Seminar in Comparative Politics (3 credits)
Prerequisite: GVPT200; and (GVPT282 or GVPT280). Restriction: Must be in Government & Politics program. Repeatable to 6 credits if content differs.
Reading, writing, and research on topics in comparative politics. Both substantive issues and methodological approaches will be considered.

GVPT 460 Problems in State and Local Government (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT260. Restriction: Must be in Government & Politics program.
A study of the structure, procedures and policies of state and local governments with special emphasis on the state level and on intergovernmental relationships, and with illustrations from Maryland governmental arrangements.

GVPT 461 Metropolitan Government (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program.
An examination of administrative problems relating to public services, planning, and coordination in a metropolitan environment.

GVPT 462 Urban Politics (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT260.
Urban political process and institutions considered in the light of changing social and economic conditions.

GVPT 473 The U.S. Congress (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program; and junior standing or higher.
A detailed survey of lawmaking and the legislative process, emphasizing the U.S. Congress, and its members.

GVPT 474 Political Parties (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program.
A descriptive and analytical examination of American political parties, nominations, elections, and political leadership.

GVPT 475 The Presidency and the Executive Branch (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program; and junior standing or higher.
An examination of the U.S. presidency in historical and contemporary perspective: nomination and electoral politics and the president's place in policy-making, administration, and public opinion.

GVPT 476 The Business Government Relationship (3 credits)
Prerequisite: GVPT241 and GVPT170. Recommended: GVPT270. Restriction: Must be in Government & Politics program.
Examines the structures, process, and outcomes of business and government and the politics and products of their cooperative-adversarial relationships in the United States. The design integrates interest group and administrative politics and the public policy process.

GVPT 477 Voting and Participation (3 credits)
Prerequisite: GVPT170 and GVPT241. Restriction: Must be in Government & Politics program.
A study of the factors that influence individual vote choice and voter participation in the U.S. The course will introduce political science research pertaining to both topics and will engage current controversies over such things as political campaign laws and the various state and federal rules that govern election administration.

GVPT 479 Seminar in American Politics (3 credits)
Prerequisite: GVPT241 and GVPT170. Restriction: Must be in Government & Politics program; and junior standing or higher. Repeatable to 6 credits if content differs.
Reading, writing, and research on topics in American politics. Both substantive issues and methodological approaches will be considered.

GVPT 481 Government and Administration of Russia and the States of the Former Soviet Union (3 credits)
Prerequisite: GVPT200; and (GVPT282 or GVPT280). Restriction: Must be in Government & Politics program.
A comparative study of the governmental systems and political processes of the states of the former Soviet Union.

GVPT 482 Government and Politics of Latin America (3 credits)
Prerequisite: GVPT200; and (GVPT282 or GVPT280). Restriction: Must be in Government & Politics program.
A comparative study of the governmental systems and political processes of the Latin American countries.

GVPT 484 Government and Politics of Africa (3 credits)
Prerequisite: GVPT282 or GVPT280. Restriction: Must be in a major within BSOS-Government & Politics department.
A comparative study of the governmental systems and political processes of the African countries, with special emphasis on the problems of nation-building in emergent countries.

GVPT 485 Government and Politics of the Middle East (3 credits)
Prerequisite: GVPT200; and (GVPT282 or GVPT280). Restriction: Must be in Government & Politics program.
A comparative study of the governmental systems and political processes of the African countries, with special emphasis on the problems of nation-building in emergent countries.

GVPT 487 Government and Politics of China (3 credits)
Prerequisite: GVPT200. Recommended: GVPT280; or GVPT282. Restriction: Must be in Government & Politics program; and junior standing or higher. Credit only granted for: GVPT359A or GVPT487. Formerly: GVPT359A.
Discussion of major issues in the study of the domestic politics of the People's Republic of China.

GVPT 599 Teaching Political Science (1 credits)
Problems in teaching political science. Topics covered include lecture and discussion strategies, creation of an active learning environment, construction and evaluation of examinations, department and university policies, and dealing with various types of teaching problems. This course does not carry credit towards any degree at the University.

GVPT 622 Quantitative Methods For Political Science (3 credits)
Introduction to quantitiative methods of data analysis, with emphasis on statistical methods and computer usage. Measures of association, probability, correlation, linear regression estimation techniques, introductory analysis of variance, and use of package computer programs.

GVPT 629 Seminar in Research Design (1 credits)
This is designed to extend and deepen graduate students understanding of research design in empirical political science. Focus is placed on major issues in planning a research project: developing strong theories, formulating clear hypotheses, and crafting strategies to test theories and rule out rival, alternative explanations. Also, issues of effective communication of research will be considered. To get beyond abstractions, examples of research in American politics will be considered and evaluated. Technical issues of statistical analysis or broader epistemological questions in social science will not be covered.

GVPT 700 Scope and Method of Political Science (3 credits)
Required of all Ph.D. candidates. A seminar in the methodologies of political science, and their respective applications to different research fields. Interdisciplinary approaches and bibliographical techniques are also reviewed.

GVPT 702 Geographic Information Systems for Social Science Research (3 credits)
Credit only granted for: GVPT368I, GVPT702, or GVPT729D. Formerly: GVPT729D.
Introduction to the use of Geographic Information Systems for conducting research in the social sciences. Overview of spatially embedded nature of many social science phenomena and content of theories common to spatial thinking. Students will obtain hands-on experience with various GIS tools and methods most frequently employed by social scientists.

GVPT 708 Seminar in International Relations Theory (3 credits)
Repeatable to 6 credits if content differs.
An examination of the major approaches, concepts, and theories in the study of world politics with special emphasis on contemporary literature.

GVPT 718 Selected Topics in Political Science (3 credits)
Repeatable to 9 credits if content differs.
Selected topics in the field of political science.

GVPT 722 Advanced Quantitative Methods For Political Science (3 credits)
Prerequisite: GVPT622; or permission of instructor.
Introduction to multivariate analysis. Elementary matrix algebra, multiple linear and curvilinear correlation and regression, analysis of variance, canonical correlation and regression, discriminant analysis, and several types of factor analysis.

GVPT 729 Special Topics in Quantitative Political Analysis (3 credits)
Prerequisite: GVPT622; or permission of instructor. Repeatable to 6 credits if content differs.
An intensive examination of special topics in quantitative methods of political analysis in such areas as survey research methods, exploratory data analysis, advanced data management techniques, or advanced methods of policy analysis.

GVPT 741 Ancient and Medieval Political Philosophy (3 credits)
Major writings from the tradition of ancient and medieval political philosophy are studied. The goal is to identify and critically analyze the perennial or persistent questions about political life posed by philosophers in divers times and places.

GVPT 742 Modern Political Theory (3 credits)
Recommended: GVPT741. Restriction: Permission of BSOS-Government & Politics department.
The influence of the Enlightenment on political thought, beginning with Machiavelli and ending around the time of Mill and Marx, in which the Enlightenment worked itself out in the hopes and fears of these and other authors.

GVPT 743 Contemporary Political Theory (3 credits)
Restriction: Must have graduate standing.
Theorists from Nietzsche (1884-1900) to the present will be covered with a focus on the apparent failure of the Enlightenment to usher in an age of peace and reason.

GVPT 761 International Political Economy (3 credits)
Recommended: GVPT708.
Major issues in international political economy including such matters as the monetary system, trade, debt, and development.

GVPT 770 Seminar in American Political Institutions (3 credits)
This is the core institutions seminar in American politics. The course surveys the primary literature in the field and addresses substantively significant topics related to the study of political institutions in the American context.

GVPT 771 Seminar in American Political Behavior (3 credits)
This is the core seminar in American political behavior. The course will deal with prominent theoretical and empirical issues in the areas of voting, public opinion, political participation and other aspects of political behavior in the American context.

GVPT 772 American Political Thought and Development (3 credits)
A survey of major American political thinkers, ongoing themes in American political thought, and fundamental questions about American political development.

GVPT 780 Seminar in the Comparative Study of Politics (3 credits)
An examination of the salient approaches to and conceptual frameworks for the comparative study of politics, followed by the construction of models and typologies of political systems.

GVPT 799 Master's Thesis Research (1-6 credits)

GVPT 803 Seminar in International Political Organization (3 credits)
A study of the forms and functions of various international organizations.

GVPT 807 Comparative Studies in International Relations (3 credits)
Prerequisite: GVPT780 or GVPT708; or permission of BSOS-Government & Politics department.
Studies in the historical, areal, structural, social and economic contexts of international relations and the influences of international relations on domestic politics, social relations and economics.

GVPT 808 Selected Topics in Functional Problems in International Relations (3 credits)
An examination of the major substantive issues in contemporary international relations.

GVPT 827 Seminar in Political Sociology (3 credits)
Prerequisite: GVPT427; or students who have taken courses with comparable content may contact the department.
Inquiries into the conceptual and theoretical foundations of and empirical data in the field of political sociology. Individual readings and research problems will be assigned, dealing with the social contexts of politics and the political aspects of social relationships.

GVPT 828 Selected Problems in Political Behavior (3 credits)
Individual reading and research reports on selected problems in the study of political behavior.

GVPT 831 Formal Theories of Politics I (3 credits)
Survey of major formal theories of politics, with emphasis on those theories based on the assumptions of rationality. The theory of public goods, game theory, coalition theory, and the theoretical properties of voting systems.

GVPT 838 Topics in Formal Political Theory (3 credits)
Prerequisite: GVPT831; or permission of instructor.
An examination of selected topics in formal theory.

GVPT 841 Great Political Thinkers (3 credits)
Prerequisite: GVPT441.
Intensive study of one or more political thinkers each semester.

GVPT 842 Man and the State (3 credits)

Prerequisite: GVPT442.
Individual reading and reports on such recurring concepts in political theory as liberty, equality, justice, natural law and natural rights, private property, sovereignty, nationalism and the organic state.

GVPT 843 Psychoanalytic Applications to Political Theory (3 credits)
Prerequisite: GVPT741.
Freudian, object relations and Lacanian traditions in psychoanalysis as they illustrate traditional questions and authors of political theory.

GVPT 844 American Political Theory (3 credits)
Prerequisite: GVPT444.
Analytical and historical examination of selected topics in American political thought.

GVPT 845 Marxist Political Theory (3 credits)
Prerequisite: GVPT443; or permission of instructor.
Intensive study and analysis of the leading ideas of Marx and Engels and their development in the different forms of social democracy and of communism.

GVPT 846 Theories of Democracy (3 credits)
Prerequisite: GVPT442.
A survey and analysis of the leading theories of democratic government, with attention to such topics as freedom, equality, representation, dissent, and critics of democracy.

GVPT 848 Current Problems in Political Theory (3 credits)
Prerequisite: GVPT443.
Intensive examination of the development of political theory since the Second World War.

GVPT 849 Readings in Government and Politics (3 credits)
Guided readings and discussions on selected topics in political science.

GVPT 856 International Human Rights (3 credits)
International law and politics of human rights viewed as a set of global issues involving civil and political as well as economic, cultural and social rights.

GVPT 859 Selected Topics in Public Policy (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
An examination of selected topics in public policy, such as judicial education, health, welfare, and resources policy.

GVPT 868 Problems of State and Local Government (3 credits)
Report of topics assigned for individual study in the field of state local government throughout the United States.

GVPT 869 Seminar in Urban Administration (3 credits)
Selected topics are examined by the team research method with students responsible for planning, field investigation, and report writing.

GVPT 870 Interest Groups Politics in the United States (3 credits)
Recommended: GVPT770.
The theory and practice of interest group politics in the United States.

GVPT 871 Seminar in Public Law (3 credits)
Reports on topics for individual study and reading in the fields of constitutional and administrative law.

GVPT 872 Judicial Process and Behavior (3 credits)
An examination and assessment of the various social scientific approaches to the study of judicial behavior and process. The "behavioral" public law, featuring the application of social science research techniques to the study of the legal process.

GVPT 873 Seminar in Legislatures and Legislation (3 credits)
Reports on topics assigned for individual study and reading about the composition and organization of legislatures and about the legislative process.

GVPT 874 Seminar in Political Parties and Politics (3 credits)
Reports on topics assigned for individual study and reading in the fields of political organization and action.

GVPT 877 The Politics of the Presidency (3 credits)
Recommended: GVPT770.
The major research topics and issues pertaining to the United States presidency.

GVPT 878 Problems in American Government and Politics (3 credits)
An examination of contemporary problems in various fields of government and politics in the United States, with reports on topics assigned for individual study.

GVPT 879 Topics on International Security (3 credits)
Recommended: GVPT876. Repeatable to 6 credits if content differs.
A detailed and advanced analysis of particular regional problems on defense policy and arms control.

GVPT 880 Civil Conflict: Theory and Research (3 credits)
Recommended: GVPT780.
An overview of historical, theoretical, and empirical analyses of conflict within states. Surveys major approaches to the study of conflict, then examines representative theories and evidence on the causes, dynamics, and outcomes of revolution, protest movements, ethnopolitical conflict, and state repression.

GVPT 883 Comparative Governmental Institutions: China (3 credits)
An examination of governments and politics within Asia.

GVPT 884 Field Methods in Comparative Politics (3 credits)
A practical designed for graduate students interested in field research. Research design, case selection, developing surveys and experiments, analysis of original data, and some qualitative methods will be emphasized, with the aim that students develop the practical skills to conduct their own field research.

GVPT 887 Seminar in the Politics of Developing Nations (3 credits)
An examination of the programs of political development in the emerging nations with special references to the newly independent nations of Asia and Africa, and the less developed countries of Latin America. Individual reporting as assigned.

GVPT 888 Selected Topics in Comparative Governmental Institutions (3 credits)
An examination of special topics in comparative politics.

GVPT 889 Selected Topics in Area Problems in International Relations (3 credits)
Special topics concerning regional problems in the relations of states.

GVPT 898 Pre-Candidacy Research (1-8 credits)
Guided readings and discussions on selected topics in political science.

GVPT 899 Doctoral Dissertation Research (1-8 credits)

ACES-Cybersecurity (HACS)

HACS 402 Applied Security Analysis and Visualization (3 credits)
Restriction: Must be a student in the ACES (Advanced Cybersecurity Experience for Students) Minor Program.
Focuses on exploratory and statistical data analysis, data and information visualization, and the presentation and communication of analysis results. These topics will be presented and explored in the context of and with applications to cybersecurity related data.

HACS 408 Advanced Seminar in Cybersecurity (3 credits)
Restriction: Must be a student in the ACES (Advanced Cybersecurity Experience for Students) Minor Program. Repeatable to 9 credits if content differs.
Explores various lenses of cybersecurity in order to promote an interdisciplinary understanding of the field. Although each section may focus on a different topic, each integrates active student engagement, communication, critical communication, critical thinking, and teamwork.

HACS 479 Undergraduate Research in Cybersecurity (1-3 credits)
Restriction: Must be a student in the ACES (Advanced Cybersecurity Experience for Students) Minor Program; and permission of UGST-HCOL-ACES Cybersecurity Program. Repeatable to 6 credits if content differs.
The Advanced Cybersecurity Experience for Students (ACES) program encourages its students to engage in research in order to gain greater insight into a specific area within cybersecurity, obtain an appreciation for the subtleties and difficulties associated with the production of knowledge and fundamental new applications, and to prepare for graduate school and the workforce.

Hebrew (HEBR)

HEBR 430 Critical Issues in Israeli Cinema (3 credits)
Also offered as: FILM430. Credit only granted for: HEBR430 or FILM430.
Critical investigation of Zionist and Israeli culture and politics through film.

HEBR 498 Special Topics in Hebrew (3 credits)
Repeatable to 6 credits if content differs.

HEBR 499 Independent Study in Hebrew (1-3 credits)
Prerequisite: Permission of instructor. Repeatable to 6 credits if content differs.
Independent study under faculty supervision.

Higher Ed, Student Affairs, and International Ed Policy (HESI)

HESI 417 Advanced Leadership Seminar (3 credits)
Prerequisite: HESI217; or students who have taken courses with comparable content may contact the department. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDCP417 or HESI417.
Students will analyze and synthesize the concept of leadership using cultural, ethical, sociological, historical perspectives. Exploration and reflection of personal values, decision making, in-depth analysis on various leadership activities. Theories will be emphasized.

HESI 418 Special Topics in Leadership (3 credits)
Repeatable to 6 credits if content differs. Credit only granted for: HESI418 or EDCP418. Formerly: EDCP418.
The special topics and leadership course will address a single topic related to leadership through the semester. In-depth study and analysis on the topic will be the basis for the course. Topics include gender and leadership, ethics and leadership, and culture and leadership. Leadership will serve as the foundation in the course.

HESI 470 Introduction to Student Personnel (3 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department. Credit only granted for: EDCP470 or HESI470. Formerly: EDCP470.
A systematic analysis of research and theoretical literature on a variety of major problems in the organization and administration of student personnel services in higher education. Included will be discussion of such topics as the student personnel philosophy in education, counseling services, discipline, housing, student activities, financial aid, health, remedial services, etc.

HESI 489 Field Experiences in Higher Education, Student Affairs, and International Education Poli (1-4 credits)
Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Planned field experience in education and community related activities. Credit not to be granted for experiences accrued prior to registration.

HESI 498 Special Problems in Higher Education, Student Affairs, and International Education Policy (1-3 credits)
Prerequisite: Available only to HISA, HIED, and HIEP students who have formal plans for individual study of approved problems. Restriction: Permission of EDUC-Counseling, Higher Education and Special Education department.
Available only to HESI students who have formal plans for individual study of approved problems.

HESI 499 Workshops, Clinics, Institutes (1-6 credits)
Repeatable to 6 credits.
The following type of educational enterprise may be scheduled under this course heading: workshops conducted by the Higher Education, Student Affairs, and International Education Policy program (or developed cooperatively with other departments, colleges and universities) and not otherwise covered in the present course listings.

Hearing and Speech Sciences (HESP)

HESP 400 Speech and Language Development in Children (3 credits)
Prerequisite: Minimum grade of C- in HESP300; or permission of BSOS-Hearing & Speech Sciences department. Recommended: LING200 or HESP120. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
Analysis of the normal processes of speech and language development in children.

HESP 402 Language and Phonological Disorders in Children (3 credits)
Prerequisite: Minimum grade of C- in HESP400; or permission of BSOS-Hearing & Speech Sciences department.
Etiology, assessment and treatment of language and phonological disorders in children.

HESP 403 Introduction to Phonetic Science (3 credits)
Prerequisite: Minimum grade of C- in HESP305; or permission of BSOS-Hearing & Speech Sciences department. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
An introduction to physiological, acoustic and perceptual phonetics; broad and narrow phonetic transcription; current models of speech production and perception.

HESP 404 Fluency & Voice Disorders (3 credits)
Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
Etiology, assessment and therapeutic management of phonation, resonance, and fluency disorders in children and adults.

HESP 406 Acquired Neurogenic Communication Disorders in Adults (3 credits)
Prerequisite: Minimum grade of C- in HESP300 and HESP305; or permission of BSOS-Hearing & Speech Sciences department. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
Survey of the dysarthrias and aphasias in adults from an interdisciplinary point of view.

HESP 407 Bases of Hearing Science (3 credits)
Prerequisite: Minimum grade of C- in HESP311; or permission of BSOS-Hearing & Speech Sciences department. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
Fundamentals of hearing, including the physics of sound, anatomy and physiology of peripheral and central auditory nervous system, psychophysical procedures used in measurement of auditory sensation and perception, and topics in psychological acoustics.

HESP 410 Organic Speech Disorders (3 credits)
Prerequisite: Minimum grade of C- in HESP305; or permission of BSOS-Hearing & Speech Sciences department. Recommended: HESP403. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department. Credit only granted for: HESP410 or HESP498C. Formerly: HESP498C.
Overview of cleft palate, pediatric and adult swallowing disorders, pediatric cerebral palsy, including dysarthria/apraxia, and their effects on communication; treatment considerations.

HESP 411 Introduction to Audiology (3 credits)
Prerequisite: Minimum grade of C- in HESP311; or permission of BSOS-Hearing & Speech Sciences department. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
An introduction to the field of audiology. Evaluation and remediation of hearing handicaps.

HESP 413 Aural Rehabilitation/Habilitation (3 credits)
Prerequisite: HESP311. Restriction: Sophomore standing or higher.
The fundamental aspects of aural rehabilitation therapy for both adults and children are introduced to students. Class time will consist of lectures, discussions, and hands-on activities.

HESP 417 Principles and Methods in Speech-Language Pathology and Audiology (3 credits)
Prerequisite: HESP400 and HESP411; and 1 course with a minimum grade of C- from (HESP402, HESP404, HESP406, HESP410). Or permission of BSOS-Hearing & Speech Sciences department. Restriction: Must be in Hearing and Speech Sciences program; or permission of BSOS-Hearing & Speech Sciences department.
The principles underlying the treatment of speech, language and hearing disorders in children and adults.

HESP 418 Clinical Practice in Speech-Language Pathology and Audiology (3 credits)
Prerequisite: Minimum grade of C- in HESP417. Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits.
Supervised observation with some direct participation in clinical methods for the treatment of disorders of articulation, fluency, child and adult language; evaluation and habilitation/rehabilitation of hearing impaired children and adults.

HESP 420 Deafness and Sign Language (3 credits)
Credit only granted for: HESP498A or HESP420.
An introduction to American Sign Language and Deaf Culture.

HESP 422 Neurological Bases of Human Communication (3 credits)
Prerequisite: HESP305; or permission of instructor. Credit only granted for: HESP498 or HESP422.
Basic neurology as it pertains to anatomy and physiology substrates of speech and language.

HESP 469 Honor Thesis Research (1-3 credits)
Prerequisite: Permission of honors thesis advisor required. Repeatable to 6 credits if content differs.
Student will develop thesis proposal, conduct research, analyze results, develop and defend final written document.

HESP 498 Seminar (3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
Selected topics in human communication and its disorders.

HESP 499 Independent Study (1-3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
A directed study of selected topics pertaining to human communication and its disorders.

HESP 600 Instrumentation in Hearing and Speech Sciences (3 credits)
Restriction: Must be in Clinical Audiology: Au.D. or Ph.D. (Doctoral) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Types and principles of operation of electronic equipment used in the hearing and speech sciences.

HESP 602 Neurological Bases of Human Communication (3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department.
Basic neurology as it pertains to anatomical and physiological substrates of speech and language.

HESP 604 Acoustical and Perceptual Phonetics (3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department.

Principles and current laboratory techniques in analysis of the acoustical characteristics of the speech signal and discussion of models of speech perception.

HESP 606 Basic Hearing Measurements (3 credits)
Prerequisite: HESP411; or students who have taken courses with comparable content may contact the department. Restriction: Must be in Clinical Audiology: Au.D. or Ph.D. (Doctoral) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Theoretical principles, methodology, and interpretation of routine audiometric tests, including pure tone, speech, and acoustic immittance measures. Modification of procedures for special populations. Equipment calibration and mass hearing screening programs.

HESP 610 Aphasia (3 credits)
Language problems of adults associated with brain injury.

HESP 612 Fluency Disorders (3 credits)
Restriction: Must be in Hearing and Speech Sciences: M.A. (Master's) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
The nature of fluency disorders. Principles, methods and procedures for the clinical management of fluency disorders in children and adults.

HESP 614 Orofacial Anomalies (3 credits)
Restriction: Must be in Hearing and Speech Sciences: M.A. (Master's) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Communication disorders related to congenital orofacial anomalies with an emphasis on cleft lip and palate. Principles, methods and procedures for clinical management.

HESP 615 Counseling in Communicative Disorders (3 credits)
Recommended: HESP400 and HESP411.
Introduction to the application of counseling principles and methodologies for working with individuals with communication disorders and their families. The role of the audiologist and speech language pathologist as counselors will be explored. Class content will focus on theoretical approaches and techniques to counseling from the fields of psychology, social work, and family the family therapy. The application of counseling in the diagnostic process as well as treatment of a wide variety of communication disorders will be highlighted throughout the course.

HESP 616 Language Disorders in Children (3 credits)
Prerequisite: HESP400; or students who have taken courses with comparable content may contact the department. Restriction: Must be in Hearing and Speech Sciences: M.A. (Master's) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Theoretical, empirical and clinical perspectives on language disorders in children.

HESP 620 Phonological and Articulatory Disorders (3 credits)
Assessment and treatement of disorders at the phonological and articulatory levels of language and speech.

HESP 622 Neuromotor Disorders of Speech (3 credits)
Restriction: Must be in Hearing and Speech Sciences: M.A. (Master's) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Effects of neuropathology on speech production. Classification and assessment of the resultant disorders and their treatment.

HESP 624 Voice Disorders (3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department.
Etiological characteristics, assessment and treatment of phonatory disorders in children and adults.

HESP 625 Dysphagia (3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Credit only granted for: HESP639B or HESP625.
Nature and clinical management of dysphagia as it pertains to different clinical settings for adult and pediatric populations.

HESP 626 Language and Learning Disabilities (3 credits)
Etiology, assessment and treatment of communication problems in children with learning disabilities.

HESP 627 Augmentative and Alternative Communication (3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Credit only granted for: HESP639R or HESP627.
Principles, methods, and procedures for categorizing, understanding, and developing augmentative and alternative communication.

HESP 630 Electrophysiological Measurements (3 credits)
Prerequisite: HESP606. Restriction: Must be in Clinical Audiology: Au.D. or Ph.D. (Doctoral) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Principles and techniques of physiological and electrophysiological measures of the audio-vestibular mechanisms.

HESP 632 Medical Audiology (3 credits)
Prerequisite: HESP311. Corequisite: HESP606.
Overview of auditory pathologies, and their assessment and management in the medical setting.

HESP 634 Anatomy and Physiology of the Auditory and Vestibular Systems (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in HESP311, HESP407, and HESP411; or permission of instructor. Additional information: Fills a requirement for the Doctoral Program in Clinical Audiology (CAUD). Open to students in other graduate programs, especially NACS.
Comprehensive examination of the anatomy and physiology of the peripheral as well as the central auditory and vestibular systems. Both afferent and efferent pathways will be considered. Applications of basic auditory neuroscience to contemporary clinical audiology practice will be highlighted.

HESP 635 Aural Rehabilitation/Habilitation (3 credits)
Principles, methods and procedures for aural rehabilitation/habilitation in children and adults.

HESP 636 Geriatric Audiology (3 credits)
Prerequisite: HESP606 and HESP700. Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)).
Research findings are presented on the physical effects of aging on the auditory periphery and central nervous system, as well as the consequences of aging on behavioral and electrophysiologic measures of auditory function. Clinical implications in the effects of physiologic

and cognitive aging on auditory performance will be discussed.

HESP 638 Research Practicum (1-3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
Analysis, synthesis and integration of knowledge related to current research or clinical issues in human communication and its related disorders.

HESP 639 Special Topics in Hearing and Speech Sciences (1-3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
Intensive coverage of selected topics of current interest.

HESP 645 Pediatric Audiology (3 credits)
Prerequisite: HESP606. Restriction: Must be in Clinical Audiology: Au.D. or Ph.D. (Doctoral) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Evaluation and treatement of hearing-impaired children.

HESP 646 Educational Audiology (3 credits)
Prerequisite: HESP606.
Recommended: HESP645.
Examination of historical and current trends influencing educational programming for hearing-impaired children, communication options for severely and profound hearing-impaired children, and the role of the audiologist in the educational setting.

HESP 648 Clinical Practice in Speech (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Supervised training in the application of clinical methods in the diagnosis and treatment of speech disorders.

HESP 649 Clinical Practice in Audiology (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Supervised training in the application of clinical methods in the diagnosis and treatment of hearing disorders.

HESP 658 Special Clinical Topics in Hearing and Speech (1-3 credits)
Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
Comprehensive coverage of selected topics pertinent to clinical issues. Specific content varies each semester, and may include supervision, clinical ethics, etc.

HESP 700 Hearing Aids (3 credits)
Principles, methods and procedures for selection, fitting, calibration and management of amplification systems for hearing-impaired children and adults.

HESP 701 Hearing Aids II (3 credits)
Prerequisite: HESP700. Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Advanced issues in amplification technology, prescriptive hearing aid selection, and management of amplification systems for special populations.

HESP 702 Diagnostic Procedures in Speech-Language Pathology (3 credits)
Restriction: Must be in Hearing and Speech Sciences: M.A. (Master's) program; and permission of BSOS-Hearing & Speech Sciences department. Or permission of instructor.
Diagnostic tools and methods in the analysis of speech-language disorders in children and adults.

HESP 706 Advanced Clinical Audiology (3 credits)
Prerequisite: HESP606; or students who have taken courses with comparable content may contact the department.
Advanced clinical and experimental methods of evaluating the peripheral and central auditory system using acoustic stimuli. Procedural considerations and interpretation of test results.

HESP 708 Independent Study (1-6 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Individual research projects under guidance of a faculty member.

HESP 710 Industrial and Environmental Noise Problems (3 credits)
Restriction: Permission of instructor.
Evaluation and control of noise hazards. Effects of noise on man. Medico-legal aspects of noise-induced hearing impairment.

HESP 712 Cochlear Implants and Other Implantable Technologies (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in HESP700, HESP701, and HESP722; or permission of instructor.
Comprehensive presentation of cochlear implant design and processing, medical/surgical aspects, evaluation, programming, outcomes in children and adults, and post stimulation care. The role of the audiologist as a member of the cochlear implant team will be emphasized. Current and emerging trends in other implantable technologies also will be covered.

HESP 722 Psychoacoutics (3 credits)
Auditory perception and auditory processing in normal and impaired hearing.

HESP 724 Research Design (3 credits)
Prerequisite: Must have completed a course in basic statistics.
Evaluations of research designs, critique of published articles and student involvement in designing experiments on assigned topics.

HESP 728 Advanced Clinical Practice in Speech (1-8 credits)
Prerequisite: HESP648. Restriction: Permission of instructor. Repeatable to 8 credits.
Clinical internship in selected off-campus facilities.

HESP 729 Advanced Clinical Practice in Audiology (1-8 credits)
Prerequisite: HESP649. Restriction: Permission of instructor. Repeatable to 8 credits.
Clinical internship in selected off-campus facilities.

HESP 730 Vestibular-ocular Assessment and Management (Electrophysiologic Measures II) (3 credits)
Prerequisite: HESP630.
Advanced principles and methods of evaluating vestibular-ocular function using electrophysiologic measures. Includes rehabilitative issues pertaining to balance disorders and advanced electrophysiologic measures of auditory system function.

HESP 788 Graduate Research Externship (1-3 credits)
Recommended: HESP724.

Off-campus research internship with departmental affiliates at National Institutes of Health and other regional universities. Contact department chairman for available placements, requirements and openings.

HESP 799 Master's Thesis Research (1-6 credits)

HESP 808 Current Research in Hearing, Speech and Language Services (1-3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
Current research in speech, language and hearing sciences and disorders.

HESP 818 Seminar in Language Processing (3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of instructor. Repeatable to 6 credits if content differs.
Information processing models of language, relationships among language, memory and cognition.

HESP 828 Seminar in Hearing Science (3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of BSOS-Hearing & Speech Sciences department. Repeatable to 6 credits if content differs.
Recent developments in auditory psychophysics, and/or anatomy and physiology of the periperal and central auditory mechanisms.

HESP 829 Clinical Internship Residency (1-9 credits)
Prerequisite: Must have completed HESP729 for two semesters; and must have completed the comprehensive exams successfully. Restriction: Permission of BSOS-Hearing & Speech Sciences department. Repeatable to 18 credits if content differs.
Off-Campus, full-time (30-40 hours/week) clinical externship in Audiology at regional and national institutions.

HESP 838 Seminar in Language Acquisition (3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of instructor. Repeatable to 6 credits if content differs.
Models of normal and disordered first language acquisition, second language acquisition and bilingualism.

HESP 848 Seminar in Audiology (3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of instructor. Repeatable to 6 credits if content differs.
Research tipics realted to hearing assissment, amplification, and audiologic rehabilitation.

HESP 849 Capstone Research Project I (2 credits)
Prerequisite: HESP724. Restriction: Must not be in Clinical Audiology: Au.D. or Ph.D. (Doctoral) program.
First of two-course sequence leading to the final research requirement for the Doctor of Audiology (Au.D.) degree; involves individual study and/or supervised lab work with mentor, preparation of research proposal (including IRB protocol if required), and attendance at Capstone Research Project Workshop.

HESP 858 Seminar in Speech Pathology (3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of instructor. Repeatable to 6 credits if content differs.
Problems in disordered articulation, voice, fluency and dysphagia.

HESP 859 Capstone Research Project II (1-2 credits)
Prerequisite: Must have completed or be concurrently enrolled in HESP849. Restriction: Must be in Clinical Audiology: Au.D. or Ph.D. (Doctoral) program.
Second of two-course sequence leading to the final research requirement for the Doctor of Audiology (Au.D.) degree; involves final data collection, analysis and presentation of results or completion of scholarly paper under the direction of the faculty mentor.

HESP 868 Seminar in Speech Science (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Problems in speech acoustics and physiology.

HESP 878 Seminar in Language Disorders (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Congenital and acquired language disorders of children and adults.

HESP 879 Academic Research Seminar (1 credits)
Restriction: Must be in Hearing and Speech Sciences: Ph.D. (Doctoral) program. Repeatable to 3 credits if content differs.
An overview of issues relevent to the research process will be provided.Topics rotate on a semester basis and include ethics, grantsmanship, professional presentations, research publications, and peer review of journal articles. A formal product (e.g., poster presentation, platform presentation, peer review, IRB application) will be required each semester.

HESP 887 Academic Research Seminar (2 credits)
Prerequisite: HESP724. Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral)). Repeatable to 6 credits if content differs.
This course has a focused, rotating set of topics each semester to cover professional and academic issues, including ethics, grantsmanship, professional presentations, professional publications, and peer review of journal articles.

HESP 888 Seminar in Neurological Bases of Language (3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral); Hearing and Speech Sciences: M.A. (Master's)) ; and permission of instructor. Repeatable to 6 credits if content differs.
Neural ststrates of language function, brain image of normal and disordered language function, and neural plasticity for language.

HESP 889 Doctoral Candidacy Research (1-3 credits)
Restriction: Must be in one of the following programs (Hearing and Speech Sciences: Ph.D. (Doctoral); Clinical Audiology: Au.D. or Ph.D. (Doctoral)) ; and permission of instructor. Repeatable to 6 credits if

content differs.
Doctoral candidacy paper research

HESP 898 Pre-Candidacy Research (1-8 credits)

HESP 899 Doctoral Dissertation Research (1-8 credits)

Historic Preservation (HISP)

HISP 600 Introductory Seminar in Historic Preservation: Theory, History and Practice (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program.
An introduction to the wide range of ideas underpinning the practice of preservation covered through readings, discussions, presentations, class projects, and field trips.

HISP 611 Historical Research Methods (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP610 or HISP611.
Research methods used by professional historic preservationists to identify and record historic structures and sites. Emphasizes inter/multidisciplinary nature of contemporary preservation practice using archival and ethnographic evidence as a basis for establishing significance.

HISP 615 The Everyday and the "American" Environment (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Also offered as: HISP200. Credit only granted for: HISP615, HISP619E, or HISP200. Formerly: HISP619E.
An introduction into the theories of the everyday with the context of the American built environment. The course focuses primarily on the American experience of underrepresented, minority, and immigrant communities; both historical and contemporary. The course attempts to challenge what is meant by American in describing the American every day built environment.

HISP 619 Special Topics in Historic Preservation (1-6 credits)
Repeatable to 12 credits if content differs.
Technical aspects of preservation taught by practitioners whose expertise are of special benefit to certificate students.

HISP 628 Selected Topics in Historic Preservation (3 credits)
Restriction: Permission of instructor.
Repeatable to 6 credits if content differs.
Critical issues in contemporary preservation practice will be examined. Topics will change each year, according to the professor's interests and the relevance of the course topic, and will include such themes as: preservation of the everyday built environment, social and ethnic dimensions of historic preservation practice, and preservation of Modern architecture and landscapes. The course will consist of readings, class, discussions, and a substantial individual research project.

HISP 629 Independent Studies in Historic Preservation (1-3 credits)
Restriction: Permission of ARCH-Historic Preservation Program.
Individual Instruction course.

HISP 630 Preservation Policy and Planning (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP619M or HISP630. Formerly: HISP619M.
An opportunity is provided to look in depth at the national historic preservation program that is the federal, tribal, state, and local (city and county) public sector preservation activities being undertaken in accordance with public policy set by laws, regulations, standards, and guidelines.

HISP 635 Social and Ethnic Issues in Historic Preservation Practice (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP628E or HISP635. Formerly: HISP628E.
This seminar course examines the broader social and ethnic dimensions of historic preservation practice that have impacted the field since the "culture wars" of the 1990's. Through weekly case studies of local, international sites, students will explore these issues and apply newly emerging methodologies to their final case study project.

HISP 640 Historic Preservation Law, Advocacy and Public Policy (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP619C or HISP640. Formerly: HISP619C.
Introduce students to legal, advocacy, and public policy issues in the field of historic preservation. Student activities will be designed to teach basic working knowledge of relevant legal subjects, including historic preservation ordinances, state and federal preservation statutes, and important constitutional issues.

HISP 645 Archaeology and Preservation (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP619A or HISP645. Formerly: HISP619A.
An introduction to issues related to archaeological resources and preservation. Topics will include method and theory in American archaeology, archaeology in support of architectural history, archaeology and the NHPA, archaeological site preservation and conservation, and curation and collections management. Students will have a chance to work at an archaeological site to experience field excavation techniques and challenges, and will visit other archaeological sites and curation facilities in the area.

HISP 650 Historic Preservation Studio Workshop (6 credits)
Prerequisite: HISP600; and permission of ARCH-Historic Preservation Program. Restriction: Must be in a major in ARCH-Historic Preservation Program.
Students carry out a group preservation project in a local community, from inception and problem formulation through completion. Guided carefully by a faculty team, students will conduct research, interact with communities, perform analyses, and propose solutions for an issue or problem of direct relevance to a local community and client group.

HISP 655 American Vernacular Architecture (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP655 or HISP619V. Formerly: HISP619V.
History, theory, and practice of American vernacular architecture including a review of common building technologies, structure, and style, and focusing on methods and approaches for recording, documenting and analyzing these historic resources.

HISP 660 Internship in Historic Preservation (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Formerly: HISP619.
Students will secure a summer internship with an organization engaged in historic preservation work (this can be a public agency, nonprofit, or private firm). The students will formulate a plan of work and a series of pedagogical goals to satisfy both the practical needs of the project and the academic requirements for the course.

HISP 670 Conservation of Historic Places: Historic Materials, Building Systems, and Conservation (3 credits)
Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP619T or HISP670. Formerly: HISP619T.
Introduces students to the analysis of

historic buildings, building systems and materials. The overall emphasis is on assessing the condition of a building and its parts, and formulating a preservation strategy based on it. Conservation methods will be discussed through the introduction of philosophies and specific techniques.

HISP 678 Fieldwork in Historic Preservation (3 credits)

Repeatable to 6 credits if content differs. Also offered as: ARCH676.
Advanced fieldwork in research and documentation of historic sites and structures including primary local history research, building analysis, survey techniques, field photography, and graphic documentation techniques.

HISP 679 Introduction to Measured Drawings for Historic Preservation (3 credits)

Repeatable to 6 credits if content differs. Also offered as: ARCH676.
Teaches graphic documentation methodologies for historic buildings, including hand measuring, drafting, preparing a sketch plan, analyzing buildings, and producing finished drawings in ink. Students will analyze building in situ.

HISP 680 Preservation Economics (3 credits)

Prerequisite: Permission of ARCH-Historic Preservation Program. Credit only granted for: HISP619N or HISP680. Formerly: HISP619N.
Students are introduced to a range of economic theories, methods, and issues that must be considered in the practice of historic preservation. Case studies related to community economic development, adaptive reuse, tax credit programs, project finance, and land use will be presented.

HISP 701 Certificate Portfolio Project (1 credits)

Prerequisite: Permission of ARCH-Historic Preservation Program.
Students will gather samples of their work and craft a synthetic statement on their experiences in their HISP certificate courses (for example, picking up on themes such as community involvement, diversity of practice, affordable housing, or sustainability), and the ways in which they have integrated historic preservation into their thinking and practice in their home discipline.

HISP 710 Final Project in Historic Preservation I (1 credits)

Credit only granted for: HISP700 or HISP710. Formerly: HISP700.
An independent, applied research project investigating the preservation of a particular site or a specialized issue in historic preservation. This is part one of a two-semester sequence and involves developing the project proposal and bibliography.

HISP 711 Final Project in Historic Preservation II (2 credits)

Credit only granted for: HISP700 or HISP711. Formerly: HISP700.
An independent, applied research project invesitgating the preservation of a particular site or a specialized issue in historic preservation. This is part two of a two semester sequence and involves project research and writing.

History (HIST)

HIST 401 Science and Gender (3 credits)

Credit only granted for: HIST401 or HIST429R. Formerly: HIST429R.
Examines the role of women and gender in the history of science. Includes consideration of barriers to women's participation in science; women's role as scientific subjects and researchers; and questions about the scientific construction of gender and the gendered construction of science.

HIST 402 The Development of Modern Physical Science: From Newton to Einstein (3 credits)

Prerequisite: MATH110. And PHYS117; or students who have taken courses with comparable content may contact the department.
The history of physics in the 18th and 19th centuries, including connections with mathematics, technology, chemistry, and planetary science. Emphasis on internal technical developments in physical theory, with discussion of experimental, philosophical, and sociological aspects. This is the second part of a three-semester sequence (HIST401, HIST402, PHYS490); each part may be taken independently of the others.

HIST 404 History of Modern Biology (3 credits)

The internal development of biology in the 19th and 20th centuries, including evolution, cell theory, heredity and development, spontaneous generation, and mechanism-vitalism controversies. The philosophical aspects of the development of scientific knowledge and the interaction of biology with chemistry and physics.

HIST 405 Environmental History (3 credits)

An introduction to the key issues and methods of environmental history. The scope of the subject is discussed, as well as its relationship with other disciplines, such as ecology, anthropology, and geography. A primary focus is environmental change in history with emphasis on the American experience.

HIST 406 History of Technology (3 credits)

The changing character of technology in modern history, beginning with the Middle Ages. Concentrates on the Industrial Revolution and its aftermath, the nature of technological knowledge and the sources of technological change.

HIST 407 Technology and Social Change in History (3 credits)

Social consequences of technological innovations and the ways in which societies have coped with new technologies.

HIST 408 Senior Seminar (3 credits)

Restriction: Must be in History program. Repeatable to 6 credits if content differs.
A capstone course for history majors, designed to increase historical knowledge and the ability to analyze texts and arguments. Topics will focus on the literature of a particular field and primary-source research.

HIST 412 History of Women and Gender in Africa (3 credits)

Prerequisite: HIST122 or HIST123; or permission of ARHU-History department. Credit only granted for: HIST412 or HIST428L. Formerly: HIST428L.
An examination of socio-economic and cultural change in Africa from the dawn of the colonial era in the 19th century to independence in the mid-twentieth century. Major focus on how African women understood and responded to the expansion of European empires, changes in the colonial economy, and impact of westernization and urbanization.

HIST 413 Revolutionary Prophets: Political and Religious Movements in Africa and the Atlantic World (3 credits)

Recommended: HIST122 or HIST123. Credit only granted for: HIST413 or HIST419V. Formerly: HIST419V.
In the expanding nineteenth-century and twentieth-century culture of the "Black Atlantic" world, investigates the intersection of African cultures, modern nationalism, prophetism, millenarianism, and social change.

HIST 415 Ideas and Politics in Europe Since 1900 (3 credits)

Restriction: Permission of instructor.
Examination of intersection of ideas and politics in Europe since 1900. Focus will be on advocates of liberalism, social democracy, fascism, Nazism,

communism, and conservatism and their impact on politics and policy since 1900.

HIST 416 History of Slavery and the Slave Trade in Africa (3 credits)

Credit only granted for: HIST416 or HIST419Y. Formerly: HIST419Y.

Examines the history and impact of the slave trade on African states, societies, and economies. Investigates the meaning of slavery in Africa, the local uses of slavery there and Africa's connections to the Trans-Saharan, Red Sea, and Trans-Atlantic slave trades.

HIST 417 Colonial Encounters: Natives, Spaniards, and Africans in the New World (3 credits)

Recommended: HIST220 and HIST250. Credit only granted for: HIST417 or HIST428Y. Formerly: HIST428Y.

An exploration of the discourses and practices of the Spanish colonial project in the New World and the ways in which Indians and Blacks were incorporated into or excluded from that project. Also examines native and African resistance and adaptation to Spanish rule, and the process of transformation and hybridization of Spanish, native and African cultures in Spanish America. An analysis of recent historiographical developments that have profoundly changed the understanding of the Spanish conquest and colonization of the New World.

HIST 418 Jews and Judaism: Selected Historical Topics (3 credits)

Prerequisite: HIST281, HIST283, HIST106, HIST286, or HIST282; or permission of instructor. Repeatable to 6 credits if content differs.

HIST 419 Special Topics in History (3 credits)

Repeatable to 9 credits if content differs.

HIST 421 Medieval Heresies (3 credits)

Credit only granted for: HIST408L or HIST421. Formerly: HIST408L.

An examination of twelfth- and thirteenth-century heresies in the medieval West. Consideration of why so many heretics emerged, and how the church attempted to deal with them, and what effect their persecution had on Europe both then and later. Special attention given to groups that stood on the fine line between heresy and orthodox religion.

HIST 425 Imperial Russia (3 credits)

The rise and fall of the Russian Empire, Peter the Great to the collapse of tsarism in revolution. Emphasis on the evolution of autocracy, social groups, national identities, and cultural change.

HIST 426 Age of Industry: Britain 1760 to 1914 (3 credits)

An economic, social, political, and cultural analysis of Britain in the age of its industrial supremacy. The nature of the first industrial revolution; the emergence of modern social classes; the cultural impact of industrialization; politics and society in the early and mid-19th century; Victorianism and its critics; imperialism and politics; high and low culture; the rise of labor; social and political tensions 1910-1914.

HIST 427 Age of Decline: Britain 1914 to Present (3 credits)

British society since the First World War. The social, cultural, economic, and political impact of the First World War; labor and politics in the 1920s and 1930s; the inter-war Depression, appeasement and foreign policy; the social impact of the Second World War; the welfare state and nationalization of industry; the dissolution of Empire; the emergence of a consumer society; social criticism in the 1950s; the economic and political problems of the 1960s and 1970s.

HIST 428 Selected Topics in History (3 credits)

Repeatable to 9 credits.

HIST 429 Special Topics in History (3 credits)

Repeatable to 9 credits.

HIST 430 Tudor England (3 credits)

An examination of the political, religious, and social forces in English life, 1485-1603, with special emphasis on Tudor government, the English reformation, and the Elizabethan era.

HIST 431 Stuart England (3 credits)

An examination of the political, religious, and social forces in English life, 1603-1714, with special emphasis on Puritanism and the English revolutions.

HIST 433 Strategic Military Theory: Clausewitz (3 credits)

Credit only granted for: HIST419J or HIST433. Formerly: HIST419J.

An exploration of Clausewitzian thought. Topics include the conduct of fighting and war planning, the relationship of war and politics, guerrilla war, the principles of concentration of force, the Clausewitzian trinity, absolute war and real war, unlimited and limited war, the relative strengths of the defense and the attack, and the intuitive sources of strategic decision.

HIST 436 Napoleon, the French Revolution, and the World (3 credits)

An argument for the broad continuity between the revolutionary and Napoleonic wars.

HIST 437 Modern France from Napoleon to DeGaulle (3 credits)

The changing political and cultural values of French society in response to recurrent crises throughout the 19th and 20th centuries. Students should have had some previous survey of either Western civilization or European history.

HIST 440 Germany in the Nineteenth Century, 1815-1914 (3 credits)

Examines the social, economic, cultural, and political development of the major German states before 1871 and of Germany, excluding Austria, from 1871 to 1914.

HIST 441 Germany Since 1900 (3 credits)

Course places Nazism in context of German and European history. Topics include collapse of German democracy and the establishment of the Nazi dictatorship; the role of Hitler; the response of political, military, economic, diplomatic, legal, media, theological elites and the broader population; the mix of terror, consent and coercion; propaganda and Nazi culture; contours of Nazi racial ideology and anti-Semitism and their impact on domestic and foreign racial policy; the economic history of the Nazi regime; foreign policy from rearmament to launching World War II to expansion and defeat; Jewish policy from the years of persecution to those of extermination; Nazi policy in Eastern and Western Europe, towards the United States, and towards North Africa and the Middle East; why the Allies won World War II and why and how Nazi Germany was defeated; the nature of the Allied occupation after 1945; the Nuremberg war crime trials; aftermath of facing and avoiding the crimes of the Nazi regime in West and East Germany.

HIST 442 Twentieth-Century Russia (3 credits)

Russia and the Soviet Union from the fall of the tsars to the post- communist present. Impact of Leninism, Stalinism, and Soviet Communism on state, society, culture, and nationality.

HIST 443 Modern Balkan History (3 credits)

Prerequisite: HIST240 or HIST113; or permission of instructor.

A political, socioeconomic, and cultural history of Yugoslavia, Bulgaria, Romania, Greece, and Albania from the breakdown of Ottoman domination to the present. Emphasis is on movements for national liberation during the 19th century and on

approaches to modernization in the 20th century.

HIST 446 Old Regime France, 1589-1789 (3 credits)

Credit only granted for: HIST419I or HIST446. Formerly: HIST419I.

An exploration of the demographic patterns of the seventeenth and eighteenth centuries. Examination of arguments that the population was governed by Malthusian constraints; the social structure of the time; the nature of the elites; the debate over the phrase "rise of the bourgeoisie"; the Enlightenment both as an intellectual phenomenon and as a social agent; and arguments that Enlightenment led to the desacralization of the monarchy.

HIST 447 Riot, Law, and Justice in European History (3 credits)

Credit only granted for: HIST428C or HIST447. Formerly: HIST428C.

An examination of the role of violence and the attempt of law to contain or punish it. Major interpretations of societal codes of honor, retribution, and punishment, and how violence is governed by these codes.

HIST 450 Economic History of the United States to 1865 (3 credits)

Prerequisite: HIST200, HIST210, HIST213, HIST222, HIST254, HIST275, or HIST311; or must have completed HIST156; or permission of instructor.

The development of the American economy from Columbus through the Civil War.

HIST 451 Economic History of the United States After 1865 (3 credits)

Prerequisite: HIST201, HIST211, HIST213, HIST222, HIST255, or HIST275; or must have completed HIST157; or permission of instructor.

The evolution of the U.S. economy from the end of the Civil War to the present; emphasis on macroeconomic policy making and relations among business, government, and organized labor.

HIST 452 Diplomatic History of the United States to 1914 (3 credits)

American foreign relations from the American Revolution to the beginning of World War I. International developments and domestic influences that contributed to American expansion in world affairs. Analyses of significant individuals active in American diplomacy and foreign policy.

HIST 453 Diplomatic History of the United States from 1914 (3 credits)

American foreign relations in the 20th century. World War I, the Great Depression, World War II, the Cold War, the Korean War, and Vietnam. A continuation of HIST452.

HIST 454 Constitutional History of the United States: From Colonial Origins to 1865 (3 credits)

The interaction of government, law, and politics in the constitutional system. The nature and purpose of constitutions and constitutionalism; the relationship between the constitution and social forces and influences, the way in which constitutional principles, rules, ideas, and institutions affect events and are in turn affected by events. The origins of American politics and constitutionalism through the Constitutional Convention of 1787. Major constitutional problems such as the origins of judicial review, democratization of government, slavery in the territories, secession, and civil war.

HIST 455 Constitutional History of the United States: Since 1865 (3 credits)

American public law and government, with emphasis on the interaction of government, law, and politics, and the relationship between the constitution and social forces and influences, the way in which constitutional principles, rules, ideas, and institutions affect events and are in turn affected by events. Major crises in American government and politics such as Reconstruction,the rise of corporate power, civil liberties during wartime, the New Deal era, the civil disorders of the 1960s.

HIST 456 History of American Culture and Ideas to 1865 (3 credits)

The culture and ideas that have shaped American society and character from the first settlements to the Civil War.

HIST 457 History of American Culture and Ideas Since 1865 (3 credits)

Prerequisite: HIST201, HIST211, HIST213, HIST222, HIST255, or HIST275; or must have completed HIST157; or permission of instructor.

A continuation of HIST456, from the Civil War to the present.

HIST 459 Society in America: Historical Topics (3 credits)

Repeatable to 6 credits if content differs.

A consideration of selected aspects of American society from colonial times to the present. Special emphasis on regionalism, immigration, nativism, minorities, urbanization, and social responses to technological changes.

HIST 460 History of Labor in the United States (3 credits)

Prerequisite: HIST200, HIST201, HIST210, HIST211, HIST222, HIST255, or HIST275; or must have completed HIST156 or HIST157; or permission of instructor.

The American working class in terms of its composition; its myths and utopias; its social conditions; and its impact on American institutions.

HIST 461 Blacks in American Life: 1865 to Present (3 credits)

Prerequisite: HIST201, HIST210, HIST211, HIST222, HIST254, HIST255, or HIST275; or must have completed HIST157; or permission of instructor.

The role of the Black in America since slavery, with emphasis on 20th-century developments: migration from farm to city; growth of the civil rights movement; the race question as a national problem.

HIST 462 Slavery, Sectionalism, and the U.S. Civil War (3 credits)

Prerequisite: HIST200, HIST213, HIST222, HIST254, or HIST275; or must have completed HIST156; or permission of instructor.

Slavery, sectionalism, and the coming of the Civil War. Resources and strategy of the Confederacy and the Union, the war's changing character, emancipation and its consequences, conditions on the home front, and the wartime origins of Reconstruction.

HIST 463 History of the Old South (3 credits)

The golden age of the Chesapeake, the institution of slavery, the frontier South, the antebellum plantation society, the development of regional identity, and the experiment in independence.

HIST 464 The North Atlantic World in the Early Modern Period, 1600-1800 (3 credits)

The American Colonies and the new American nation: their European heritage and influences.

HIST 466 Immigration and Ethnicity in the U.S. (3 credits)

Prerequisite: AAST200, AAST201, AAST222, HIST200, HIST201, HIST221, or HIST222; or must have completed HIST156 or HIST157; or permission of ARHU-History department. Credit only granted for: AAST498L or HIST466.

Seminar exploring historical problems relating to US immigration, race, and ethnicity since 1848, with emphasis on cultural impacts of migration on immigrants, their children, and U.S. society.

HIST 467 Women and Reform Movements in the Twentieth-Century United States (3 credits)
Recommended: HIST201, HIST211, or HIST255. Credit only granted for: HIST467 or HIST429E. Formerly: HIST429E.
Investigation of women's participation in such twentieth-century reform movements as the labor movement, the struggle for racial justice, social welfare reform, and women's movements. Will ask how race, class, and gender were implicated in the ways that women agitated for social political change.

HIST 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

HIST 471 History of Brazil (3 credits)
Prerequisite: LASC234, HIST251, HIST250, or LASC235; or permission of instructor.
The history of Brazil with emphasis on the national period.

HIST 473 History of the Caribbean (3 credits)
Prerequisite: HIST112, HIST113, HIST122, HIST123, HIST240, HIST250, or HIST251.
Offers a concise introduction to the history of the Caribbean regions from the Columbian voyages to the 20th century. Special emphasis is given to the dynamics of local social and cultural formations within the framework of the political and economic history of the Atlantic world.

HIST 474 History of Mexico and Central America I (3 credits)
Prerequisite: LASC234, HIST251, or LASC235; or permission of instructor.
History of Mexico and Central America, beginning with the pre-Spanish Indian cultures and continuing through European contact, conquest, and colonial dominance, down to the beginning of the Mexican War for Independence in 1810.

HIST 475 History of Mexico and Central America II (3 credits)
Prerequisite: LASC234, HIST251, or LASC235; or permission of instructor.
A continuation of HIST474 with emphasis on the political development of the Mexican nation.

HIST 476 Jews in Medieval Times 1000-1450 (3 credits)
Recommended: HIST282 or JWST234; and (HIST330 or HIST331). Also offered as: JWST432. Credit only granted for: HIST419R, HIST476, JWST429M, or JWST432. Formerly: HIST419R.
Social and cultural life of Jewish communities spread throughout Islam and Christendom. Major topics include the Gaonate, kehila organizations, legal, rationalist, and mystical thought, and the context of rising animosity against Jews linked to the Crusades and changing Church doctrines.

HIST 477 Afro-Diasporic Dialogues in the Americas (3 credits)
Prerequisite: HIST122, HIST123, HIST250, HIST251, HIST254, or HIST255.
The African diaspora is a concept that attempts to comprehend the share experiences of African-descended peoples throughout the world, particularly in the Americas. While many of these peoples identify with a particular nationality (being Brazilian, Cuban, or from the United States above or alongside being black, of color, or of African descent), many of them have forged connections with each other across national boundaries and recognized commonalities that transcend their national contexts. This class will use fiction, memoir, and recent historical scholarship to explore the history of the links that Afro-Latin American and Afro-North Americans have created in the nineteenth and twentieth centuries. Ultimately, the course will help us understand the historical possibilities and limitations of conceiving of African Americans as a hemispheric, transnational social group.

HIST 480 History of Traditional China (3 credits)
China from earliest times to 1644 A.D. Emphasis on the development of traditional Chinese culture, society, and government.

HIST 481 A History of Modern China (3 credits)
Modern China from 1644 to the People's Republic of China. Emphasis on the coming of the West to China and the various stages of the Chinese reaction.

HIST 482 History of Japan to 1800 (3 credits)
Traditional Japanese civilization from the age of Shinto mythology and introduction of continental learning down to the rule of military families, the transition to a money economy, and the creation of a townsmen's culture. A survey of political, economic, religious, and cultural history.

HIST 483 History of Japan Since 1800 (3 credits)
Japan's renewed contact with the Western world and emergence as a modern state, industrial society, and world power, 1800-1931; and Japan's road to war, occupation, and recovery, 1931 to the present.

HIST 484 Cultural History of the Chinese Revolutions (3 credits)
Recommended: HIST481 or HIST285. Credit only granted for: HIST419G or HIST484. Formerly: HIST419G.
Examines the cultural origins, experience, and results of the Cultural Revolution in China.

HIST 486 Social Issues in Modern China (3 credits)
Recommended: HIST285; and HIST481. Credit only granted for: HIST419N (Fall2007) or HIST486. Formerly: HIST419N.
Explores the problems surrounding family, community, and social life in modern China, including a focus on issues that affect groups and subcultures within the population. Examines as well the political system's capacity to regulate this complex society.

HIST 491 History of the Ottoman Empire (3 credits)
Survey of the Ottoman Turkish Empire from 1300 A.D. to its collapse during World War I. Emphasis on the empire's social and political institutions and its expansion into Europe, the Arab East and North Africa.

HIST 492 Women and Society in the Middle East (3 credits)
Recommended: Must have completed prior coursework in Middle East studies or gender studies. Also offered as: WMST456. Credit only granted for: HIST492 or WMST456.
Examines the customs, values, and institutions that have shaped women's experience in the Middle East in the past and in the contemporary Middle East.

HIST 493 Victorian Women in England, France, and the United States (3 credits)
Also offered as: WMST453. Credit only granted for: HIST493 or WMST453.
Examines the lives of middle- and upper-class women in England, France, and the United States during the Victorian era. Topics include gender roles, work, domesticity, marriage, sexuality, double standards, and women's rights.

HIST 495 Women in Medieval Culture and Society (3 credits)
Also offered as: WMST455. Credit only granted for: HIST495 or WMST455.
Medieval women's identity and cultural roles: the condition, rank and rights of medieval women; their access to power; a study of women's writings and the constraints of social constructs upon the female authorial voice; and contemporary assumptions about women.

HIST 496 Africa Since Independence (3 credits)
Analysis of socio-political and econo-political changes in Africa since approximately 1960; development of class structures, the role of the military, personal rule, and the patrimonial state; decline of party politics and participatory politics. Discussion of changes in economic policies, policies with respect to rural communities, and their relationship to the state and decision-making.

HIST 499 Independent Study (1-3 credits)
Restriction: Permission of ARHU-History department. Repeatable to 6 credits.

HIST 600 Historiography (3 credits)
Historical writing and critical analysis of selected interpretations and generalizations made by leading historians with examples from both European and United States history.

HIST 601 History and Contemporary Theory (3 credits)
An introduction to contemporary theories in philosophy, literary criticism, cultural studies, anthropology, and other fields; and analysis of their usefulness to historians.

HIST 606 Seminar in the History and Philosophy of Science and Technology (3 credits)
Credit only granted for: HIST606 or PHIL650.
Fundamental problems and current research in the history of science and technology; theories of historical change applied to selected cases in physical and biological science and in technology; historiographic and philosophical issues pertaining to these cases.

HIST 607 The Teaching of History in Institutions of Higher Learning (1 credits)

HIST 608 General Seminar (3 credits)
Restriction: Permission of ARHU-History department. Repeatable to 9 credits if content differs.
General seminar in student's major field of study (e.g., U.S.; Women and Gender; International, World, and Comparative; Science and Technology; Latin America) exploring the concentration's major issues, topics, and literature.

HIST 609 Readings in the History of Science and Technology (3 credits)

HIST 610 Introduction to Museum Scholarship (3 credits)
Also offered as: AMST655. Credit only granted for: AMST655, ANTH655, or HIST610.
Provides students a basic understanding of museums as cultural and intellectual institutions. Topics include the historical development of museums, museums as resources for scholarly study, and the museum exhibition as medium for presentation of scholarship.

HIST 618 Readings in Women's and Gender History (3 credits)

HIST 619 Special Topics in History (1-3 credits)

HIST 628 Readings in Colonial American History to 1763 (3 credits)
Major historical literature on various groups and developments in the European colonies that later became the United States through the period ending with the British-French "Great War for Empire."

HIST 629 Readings in the American Revolution and New Nation, 1763 to 1812 (3 credits)

HIST 638 Special Topics in History (3 credits)
Repeatable to 9 credits if content differs.
Special Topics in History.

HIST 639 Special Topics in History (3 credits)
Repeatable to 9 credits if content differs.
Special Topics in History.

HIST 648 Readings in Early 20th-Century America, 1900-1941 (3 credits)
Major historical literature on various groups and developments in the United States between the Progressive Era and the beginning of World War II.

HIST 649 Readings in Recent American History, 1941-Present (3 credits)
Key subjects, themes, and historiographic debates in the history of the United States from 1941 to the present.

HIST 658 Readings in American Constitutional and Legal History (3 credits)
Historical literature on the American constitutional order from the colonial foundations to the present. The founding and development of political and constitutional institutions examined from the perspectives of law, politics, government and political philosophy.

HIST 659 Readings in American Cultural and Intellectual History (3 credits)
Major historical literature pertinent to the cultural/intellectual development of the varied peoples of the United States.

HIST 668 Readings in American Social History (3 credits)
Major historical literature related to specific issues in the social history of the United States.

HIST 669 Readings in U.S. Economic and Business History (3 credits)
Repeatable to 6 credits.
An overview of U.S. economic and business history and historiography from colonial times to the present. Emphasizes the methodologies of "new" economic historians and institutional business historians, the evolving role of the state in the American economy, and cultural dimensions of economic change.

HIST 678 Readings in American Labor History (3 credits)
Major historical literature related to the development of the American working class, the labor movement, and gender/racial/ethnic issue within them.

HIST 679 Readings in the History of American Foreign Policy (3 credits)
Major historical literature related to the diplomacy and international relations of the United States.

HIST 686 Readings in the North Atlantic World (3 credits)
The American Colonies and the early United States as part of the early modern North Atlantic community (1600-1815) brought together by such things as a common culture, trade networks, religious currents, shared scientific interests, similar attitudes to society, and an emerging appreciation of consumer goods.

HIST 689 Readings in Southern History (3 credits)
Major historical literature centered on the development and peoples of the southern United States.

HIST 698 Professional Internship (3 credits)
Restriction: Must be in one of the following programs (History (Master's); History (Doctoral)). Repeatable to 6 credits if content differs.
Internship with a professional organization in the historical disciplines or related fields.

HIST 708 Directed Independent Reading for Comprehensive Examinations I (1-4 credits)
Restriction: Permission of ARHU-History department. Repeatable to 12 credits if content differs.
Directed reading in preparation for Doctoral Comprehensive Examinations. In consultation with their advisors, students will select a number of books and articles from an approved list. Grading for the course will reflect performance on the written and oral sections of the Comprehensive Examinations.

HIST 709 Directed Independent Reading for Comprehensive Examinations II (1-4 credits)
Repeatable to 12 credits if content differs.
Directed reading in preparation for Doctoral Comprehensive Examinations. In consultation with their advisors, students will select a number of books and articles from an approved list. Grading for the course will reflect performance on the written and oral sections of the Comprehensive Examinations.

HIST 711 Final Project in Historic Preservation II (2 credits)
Credit only granted for: HISP700 or HISP711. Formerly: HISP700.
An independent, applied research project investigating the preservation of a particular site or a specialized issue in historic preservation. This is part two of a two-semester sequence and involves project research and writing.

HIST 718 Readings in Medieval History (3 credits)

HIST 719 Readings in the History of the Renaissance and Reformation (3 credits)

HIST 720 Readings in the History of the Catholic Church (3 credits)
This is graduate-level readings seminar in the modern history of the Catholic Church. We will begin with the Reformation and proceed through the present day. This course will combine European history with global history, looking both at how the Church changed in the face of major turning points in modern European history (the Scientific, French, and Russian Revolutions; the two world wars; and the Cold War) and at its missionary encounters and long-term presence across the world (in Latin America, India, China, Africa, and North America).

HIST 729 Readings in Modern European History (3 credits)
Reading knowledge of some European language recommended but not required.

HIST 739 Readings in the History of Great Britain (3 credits)

HIST 748 Readings in Modern French History (3 credits)

HIST 749 Readings in German History, 1815 to the Present (3 credits)
Repeatable to 9 credits if content differs.
Reading knowledge of German is encouraged, but not required.

HIST 758 Readings in Eastern European History (3 credits)
Repeatable to 6 credits if content differs.
Selected topics in the history of the Hapsburg monarchy and the successor states, Poland and the Balkans. Emphasis on the rise of nationalism during the 19th century and the experience with fascism and communism in the 20th century.

HIST 759 Readings in Russian and Soviet History (3 credits)

HIST 768 Readings in Chinese History (3 credits)

HIST 778 Readings in Latin American History (3 credits)

HIST 779 Readings in Middle Eastern History (3 credits)

HIST 789 Readings in Modern European Intellectual History (3 credits)

HIST 798 Readings in Jewish History (3 credits)
Repeatable to 6 credits.
Readings on selected topics in Jewish history. Emphasis on analysis of primary sources. Reading knowledge of Hebrew recommended.

HIST 799 Master's Thesis Research (1-6 credits)

HIST 808 Seminar in the History of Science and Technology (3 credits)

HIST 809 Seminar in the History of Women and Gender (3 credits)
Repeatable to 9 credits if content differs.

HIST 810 Museum Research Seminar (3 credits)
Prerequisite: HIST610. Also offered as: ANTH856, AMST856. Credit only granted for: AMST856, HIST810, or ANTH856.
A research seminar focusing on the practice and presentation of cultural and historical scholarship in museums and historical sites. Students will complete an original research project on the challenges and opportunities of public exhibition and interpretation of cultural and historical research.

HIST 811 Museum Scholarship Practicum (3-6 credits)
Prerequisite: HIST810. Restriction: Permission of Museum Scholarship Program required. Also offered as: ANTH857, AMST857. Credit only granted for: ANTH 857, AMST857 or HIST811.
Students devise and carry out a research program using the collections at the Smithsonian Institution or some other cooperating museum, working under joint supervision of a museum professional and a university faculty member.

HIST 819 Special Topics in History: Independent Research (1-3 credits)
Restriction: Must be in History program; and permission of ARHU-History department. Repeatable to 6 credits if content differs.
Individual graduate research in an area not covered by current seminar offerings. The product will be a finished research paper normally based on original materials.

HIST 829 Seminar in Latin American History (3 credits)

HIST 838 Seminar in Ancient History (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.

HIST 839 Seminar in Medieval and Early Modern European History (3 credits)

HIST 840 Seminar in Greek History (3 credits)

HIST 841 Seminar in Roman History (3 credits)

HIST 848 Seminar in Modern European History (3 credits)

HIST 849 Seminar in Russian and Soviet History (3 credits)

HIST 850 Seminar in East European History (3 credits)
Research papers on the history of the lands which are now Austria, Hungary, Czechoslovakia, Poland and the Balkan states, from the 18th century to the present.

HIST 869 Seminar in Recent American History (3 credits)

HIST 878 Seminar in Colonial American History (3 credits)

HIST 879 Seminar in the American Revolution and Formative Period (3 credits)

HIST 880 Seminar in Southern History (3 credits)

HIST 888 Seminar in the Middle Period and Civil War (3 credits)

HIST 890 Seminar in American Culture and Ideas (3 credits)

HIST 892 Seminar in American Social History (3 credits)

HIST 894 Seminar in American Labor History (3 credits)
Advanced research and writing on selected topics in the history of American workers, their conditions, communities, organizations and ideas.

HIST 895 Seminar in American Constitutional History (3 credits)

HIST 896 Seminar in the History of American Foreign Policy (3 credits)

HIST 898 Pre-Candidacy Research (1-8 credits)

HIST 899 Doctoral Dissertation Research (1-8 credits)

Health and Human Performance (HLHP)

HLHP 615 Crises of Aging: Time, Retirement and Widowhood (3 credits)
Formerly: PERH615.
A cross-disciplinary and multidisciplinary investigation of phenomena which comprise a significant portion of the issues confronting an older adult's life: (1) introduction to multiple processes of adulthood and aging; (2) the concepts and meaning of time; (3) pre-retirement and retirement adjustments; and (4) loss and widowhood.

HLHP 625 Issues in Retirement: Theory and Practice (3 credits)
Formerly: PERH625.
Multidisciplinary examination of retirement phenomena, including theories of transition, government and private sector policies, social expectations, physical correlates, personal adjustments, and economic consequences. Emphasis upon research utilization.

HLHP 688 Field Work in Aging (1-6 credits)
Prerequisite: Permission of SPHL-School of Public Health. Formerly: PERH688.
Sequences of supervised field experience in the field of aging, including direct service, administration, research, or training. Emphasis on career exploration and assessment in relation to the field of aging.

HLHP 689 Selected Problems in Health, Physical Education and Recreation (1-6 credits)
Formerly: PERH689.
Research projects in special areas in health, physical education and/or recreation which have interdisciplinary implications not covered in structured courses.

HLHP 780 Interdisciplinary Issues in Aging (3 credits)
Formerly: PERH780.
Multidisciplinary approaches to the processes of aging to achieve a more holistic understanding. Pedagogical research dissemination, peer instruction, guest lecturing, and informal discussion. The demonstration of the multilateral nature of growing older. Discussion of cross-disciplinary and interdisciplinary research proposals.

Health Services Administration (HLSA)

HLSA 601 Introduction to Health Systems (3 credits)
Restriction: Must not have completed HLTH740. Credit only granted for: HLSA601, HLTH688A, or HLTH740.
Formerly: HLTH688A or HLTH740.
Management and leadership skills for effective public health planning, organization, management and administration. Emphasis is on the role of institutions in learning and behavioral change process, organizational theory, administration management, and coordinating provision of community health services.

HLSA 688 Independent Study (1-6 credits)
Prerequisite: Permission of SPHL-Health Services Administration department. Repeatable to 9 credits if content differs.
Master or doctoral students who desire to pursue special research problems under the direction of a faculty memeber of the department may register for 1-6 hours of credit under this number.

HLSA 689 Field Work in Aging (1-6 credits)
Prerequisite: Permission of SPHL-Health Services Administration department. Repeatable to 6 credits if content differs. Formerly: SPHL688.
Individual instruction course.

HLSA 702 Policy and Politics of Health (3 credits)
Organizational and financial components of the U.S. health care system, including social and political forces that bind the system. Advanced political analysis of the health care system, including key issues and problems.

HLSA 703 Seminar in Health Equity (1 credits)
Student-led presentations and discussion of contemporary literature in the areas of health disparities and health equity, social determinants, (eg. race, ethnicity, sex, age, sexual identity, disability, socioeconomic status, and geographic location) and policies and programs to address disparities. The emphasis is on papers describing new research findings, novel techniques, innovative methods, and emerging issues.

HLSA 709 Current Topics in Health Services (1-3 credits)
Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor. Repeatable to 3 credits if content differs.
A focus on analyzing, synthesizing and managing current and emerging issues in health services including, but not limited to, policy, legislation, management, practice, health systems, financing and insurance, ethics, technology, organizational and social change, marketing, health determinants, global health, evaluation and research, among others. Topics will complement and enrich the knowledge and skills acquired throughout the program. Readings, interactive discussions, team projects, in class presentations and related assignments.

HLSA 710 Healthcare Mangement: Foundations and Principles (3 credits)

Restriction: Must be in Master of Health Administration (Master's) program; or must be in Health Services Ph.D. (Doctoral) program.
Concepts and managerial activities essential to achieve the goals of health care organizations are examined and discussed. Managerial processes include planning, decision-making, etc. required to operate and change health care organizations will be discussed. Special emphasis will be placed on the leader/managers role in developing and maintaining an effective system for providing healthcare.

HLSA 711 Health Economics and Analysis (3 credits)
Provides an analysis of health and health care services as economic goods. Using microeconomic theories, we will examine the behavior of health care providers, consumers, markets, and firms.

HLSA 713 Seminar in Health Policy (1 credits)
Student-led presentations of contemporary literature in the areas of health policy, health care reform in the nation and Maryland, and evaluation of health policies and programs. Emphasis on papers describing new research findings, novel techniques, innovative methods, and emerging issues.

HLSA 714 Economic Evaluation of Medical Care (3 credits)
Prerequisite: HLSA601 and EPIB650; or students who have taken courses with comparable content may contact the department.
An overview of the theory and applications of cost-benefit analysis, cost-effectiveness analysis, and related forms of economic evaluation/decision analysis in the health care sector.

HLSA 720 Health Law and Ethics (3 credits)
The legal system helps determine the relationships prevailing among individuals, institutions and governments by setting out the rights, duties and powers of the various parties. This course will look at some of the more important concepts the law uses within the context of health services and public health.

HLSA 721 Using Demographic Data for Health Policy Analysis (3 credits)
Prerequisite: EPIB650; or students who have taken courses with comparable content may contact the department; or permission of instructor. Additional information: Priority enrollment will be given to students in the Department of Health Services Administration programs.
The goal of this course is to introduce students to the major demographic data sets that are used in health policy research and to provide hands-on experience using these data to answer policy oriented research questions

HLSA 723 Health Policy Analysis and Advocacy (3 credits)
Prerequisite: HLSA601.
Examination of the politics of the health policy process, including the effects of American political structure and institutions; economic and social factors; interest groups, classes, and social movements; media and public opinion, and other factors. The emphasis is both on understanding how public policy is made as well as how to influence the process.Students will learn about (1) how health policy is developed, adopted, and implemented, (2) the political, institutional, economic, social, and other factors that influence and shape the process, and (3) the basic approaches and tools of strategic advocacy.

HLSA 725 Econometrics in Public Health (3 credits)
Prerequisite: EPIB650; or students who have taken courses with comparable content may contact the department. Additional information: priority enrollment will be given to students at the School of Public Health.
Empirical course to introduce students to econometric methods and their applications in public health.

HLSA 730 Healthcare Human Resources (3 credits)
Provides an introduction to the management of human resources in the healthcare setting using basic human resources management doctrine common to all industries. Content includes principles and methods of personnel including employment, recruitment, selection, retention, training and development, compensation including wage and salary administration performance appraisal, job analysis and labor relations.

HLSA 733 Topics in Health Care Reform (3 credits)
Prerequisite: HLSA601, HLSA702, or HLSA711.
An overview of the Patient Protection and Affordable Care Act of 2010 (ACA) and the major health care reforms explicitly included in the law, while also considering the state implementation decisions and provider innovation that has occurred over time due to the ACA is provided. It will address issues of implementation of Medicaid expansion, the state and federal Exchange, costs of care and efficiency, improving quality and patient safety as well as prevention and public health. We will discuss the actual process of passing the law, what compromises were made, the funding sources, recent changes, regulations, state decisions, waivers, and demonstration or pilot programs that have been developed and/or funded due to the law. We will also focus on the implementation of the law in Maryland, where the legislature and governor decided to expand Medicaid and create a state-based insurance exchange. However, the impacts of the law could be different in Maryland than in other states due to the population, moderate politics, and the presence of state price setting authority for hospitals and other providers.

HLSA 740 Healthcare Strategic Planning and Marketing (3 credits)
Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.
An understanding of strategic management and marketing is provided which enables the students to lead the process of strategic planning in a healthcare organization. By conducting a marketing and strategic planning process, health care organizations are better able to cope with dramatic changes in technological, social, political, regulatory, and competitive aspects of the health care market. Strategic management enables organizations to identify issues unique to them, which hinder or promote organizational success. Through course readings, class discussions, analyses of secondary quantitative and qualitative data, and presentation of case studies, students gain a thorough understanding of the strategic management process. Students will apply core competencies through a comprehensive strategic and marketing plan. Plans will be defended through an oral presentation.

HLSA 745 Public Health Practice and Management (3 credits)
Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.
Examines the relationship of practice and management in performing essential public health services on local, state and national levels.

HLSA 750 Healthcare Management Information Systems (3 credits)
Provides a background and overview of the analysis, design, evaluation, selection, installation, use, and mangement of information systems in health care settings. Students will review the information management function and value of information and the role of information technology in the provision of high quality care and management decision making. Details on computer hardware, software, networking, and telecommunications sufficient for understanding of concepts relevant to health care managers and staff will be addressed.

HLSA 760 Healthcare Financial Management (3 credits)
Offers content in health services financial management with emphasis on applying

traditional financial theories to health care and the health care system. Focus on decision-making using accounting and finance theories, principles, concepts and techniqes most important to health care leaders.

HLSA 765 Oral and Written Communication in Healthcare (3 credits)

Acquaint students with a variety of types of professional writing required of health service professionals, including: grant proposals; journal articles; textbooks; presentation proposals and papers; and theses and dissertations.

HLSA 770 Continuous Quality Improvement in Healthcare (3 credits)

Designed for the health care professional or administrator involved in quality assurance in health care. Course includes historical beginnings, state-of-the-art, voluntary, governmental efforts, and tools to promote quality assurance.

HLSA 772 Healthcare Leadership and Communications (3 credits)

Health care administrators rely on transformational leadership skills and insights to help their organizations rise to the social financial, public health, and technological challenges of the future. Students will assess and develop their leadership strengths, apply key leadership communication principles, and critically analyze relevent leadership models, exploring their utility in addressing key leadership issues in health care organizations. An underlying theme will be the identification of core values involved in health care delivery, integration of those values in personal and organizational missions, and effective communication to stakeholders.

HLSA 775 Public Health Research (3 credits)

Prerequisite: EPIB650. Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.

Provides an interdisciplinary approach to gaining an understanding of and acquiring the skills to conduct public health research. This course covers policy and social issues, theory, and methods of evaluation and participatory research, from simple community based health programs to large-scale interventions. The course emphasizes experimental and quasi-experimental designs to estimate program impact as well as evaluation of program implementation. Case studies drawn from the public health field illustrate various types of evaluations and participatory research initiatives. Lectures, interactive discussions, group projects, individual projects and related assignments.

HLSA 780 Qualitative Methods for Health Services Research (3 credits)

Qualitative research is a multi-methods approach to the study of social interactions in natural settings. Through triangulation of methods, the researcher attempts to make sense of, or interpret, phenomema in terms of the meanings people bring to them.

HLSA 785 Internship in Public Health (3 credits)

Prerequisite: Permission of SPHL-Health Services Administration department.

Internship and seminar providing an opportunity to apply previously acquired knowledge and skills in a health or allied health organization. Setting of the internship will depend upon the student's background and career goals.

HLSA 786 Capstone Project in Public Health (3 credits)

Prerequisite: Permission of SPHL-Health Services Administration department.

Capstone experience provding opportunity to apply knowledge and skills to a specific public health problem or issue. Completion of project relevant to public health under the direction of an advisor.

HLSA 787 Minority Health and Health Equity (3 credits)

Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.

A critical analysis of historical, political, economic, social, cultural, and environmental conditions that have produced an inequitable health status for racial and ethnic minorities in the United States.

HLSA 788 Critical Readings in Health Services Research (3 credits)

Repeatable to 9 credits if content differs.

Current and classic readings and research on various aspects of the health services research including the health care system, health care policy and social science research on health (including economics, psychology, political science, sociology etc.). The readings will be critically analyzed and applied to students research and current research as well as applications to health services research issues.

HLSA 790 Advanced Methods in Health Services Research (3 credits)

Prerequisite: EPIB650 and EPIB651; or permission of instructor.

Provides an in-depth examination of health services research literature with emphasis on methodological scrutiny and application of methods beyond linear regression such as categorical regression, survival analysis, selection issues, and endogeniety.

HLSA 791 Advanced Research Seminar II (3 credits)

Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.

Introduces pre-candidates at the end of their coursework to methods for locating, downloading and processing secondary data sources with complex survey design. The course emphasizes analysis of the Medical Expenditure Panel Survey (MEPS) data with Stata statistical software. The analysis and synthesis skills acquired throughout the students' doctoral coursework are applied to write and conduct analysis for a publishable journal article.

HLSA 792 Health Services Portfolio Seminar I (3 credits)

Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.

Assists doctoral pre-candidates at the end of their coursework with completing the required research portfolio requirements.

HLSA 793 Health Services Portfolio Seminar II (3 credits)

Restriction: Must be in a major in SPHL-School of Public Health; or permission of instructor.

Introduces students to the main sections of a publishable paper. This is an applied course so students are expected to learn how to critique a research article and how to write a publishable one. By the end of this course, each student is expected to have written a publishable paper with a formal abstract, specific to their research topic.

HLSA 799 Master's Thesis Research (1-6 credits)

HLSA 898 Pre-Candidacy Research (1-8 credits)

HLSA 899 Doctoral Dissertation Research (1-8 credits)

Health (HLTH)

HLTH 400 Service/Learning in Health Education (3 credits)

Prerequisite: Permission of SPHL-Behavioral & Community Health department. Restriction: Junior standing or higher; and must be in Community Health program.

Application of health education knowledge and skills to serve health education needs in the community. Combines community service with preparation and reflection.

HLTH 410 Honors Seminar (3 credits)
Prerequisite: HLTH200; and must have completed 2 other courses in HLTH. Restriction: Minimum cumulative GPA of 3.5; and must have completed 45 credits before applying.
Undergraduate majors with a strong academic record are provided the opportunity to engage in challenging educational experiences related to the social and behavioral aspects of public health. Students will learn the skills and knowledge to develop, propose, defend, and complete an honors thesis or honors project.

HLTH 420 Methods and Materials in Health Education (3 credits)
Prerequisite: HLTH301 and HLTH391. Corequisite: HLTH490.
The purpose of this course is to present the interrelationships of curriculum planning, methodology and the selection and use of teaching aids and materials. Special problems associated with health teaching are discussed. Students become familiar with a variety of resources as well as with planning for and presenting demonstration lessons.

HLTH 430 Health Education in the Workplace (3 credits)
A survey of the role of health education in work settings. Examination of occupational stress, the health effects of shift work, women's health in the workplace, health education approaches to informing workers and management, and health promotion programs in the workplace.

HLTH 434 Introduction to Public Health Informatics (3 credits)
Credit only granted for: HLTH434 or HLTH498E. Formerly: HLTH498E.
Provides an overview of the field of public health informatics and the influence of technology on the public's health and well-being. Emphasizes the application of various technologies and computer/internet applications to support public health research and practice, including strategies to address new and emerging threats.

HLTH 437 Consumer Behavior (3 credits)
Prerequisite: SOCY100 and PSYC100.
An application of the behavioral sciences to a study of consumer behavior. Current theories, models and empirical research findings are explored.

HLTH 460 Minority Health (3 credits)
Prerequisite: HLTH140 or HLTH230; or permission of SPHL-Behavioral & Community Health department. Restriction: Must be in a major within SPHL-Behavioral & Community Health department.
Health concerns of U.S. ethnic minority groups and factors placing them at elevated risk for disease and injury. Health education concepts and strategies to reduce disparities between their health status and the health status of the general population.

HLTH 471 Women's Health (3 credits)
Restriction: Must be in a major within SPHL-Behavioral & Community Health department; or must be in a major within ARHU-Women's Studies department. Also offered as: WMST471. Credit only granted for: HLT471 or WMST471.
The historical, physiological, psychological, and sociological mechanisms which contribute to women's health. Topics will include gynecological concerns and reproductive health; nutrition, exercise; violence; substance use/abuse; and the health of special populations.

HLTH 476 Death Education (3 credits)
Examination of the genesis and development of present day death attitudes and behavior by use of a multidisciplinary life cycle approach.

HLTH 489 Field Laboratory Projects and Workshop (1-6 credits)
A course designed to meet the needs of persons in the field with respect to workshop and research projects in special areas of knowledge not covered by regularly structured courses.

HLTH 490 Principles of Community Health II (3 credits)
Prerequisite: HLTH301 and HLTH391. Corequisite: HLTH420.
Students will be involved in the applied aspects of community health education. They will work with specific local community groups, planning, developing, implementing and evaluating a community health project. Health agencies and community health marketing techniques will be investigated.

HLTH 491 Community Health Internship (12 credits)
Prerequisite: HLTH490. Restriction: Must be in Community Health program.
Integrating theory with practice in a community health setting.

HLTH 498 Special Topics in Health (3 credits)
Repeatable to 6 credits if content differs.
Topics of special interest in areas not covered by regularly scheduled courses.

HLTH 606 Foundations of Public Health Education and Policy (3 credits)
Restriction: Must be in MPH: Community Health Education (Master's) program; or must be in Ph.D.: Public and Community Health (Doctoral) program.
Examines foundations and content of two professions, health education and public health, including history, mission, terminology, philosophy, ethical principles and scientific foundations. Emerging and reemerging threats to the public's health will be discussed, as well as societal influences on health and health policy. Also addresses professional competencies and preparation, and the role of professional organizations.

HLTH 652 Quantitative Research Methods I in Public health (3 credits)
Restriction: Must be in MPH: Community Health Education (Master's) program; or must be in Ph.D.: Public and Community Health (Doctoral) program. Credit only granted for: HLTH652 or HLTH688R. Formerly: HLTH688R.
Intermediate statistics and procedures in public health-related research for doctoral students. Focuses on applied statistics rather than theoretical, with emphasis on 1) how to apply statistical models, 2) how to perform the analysis with avialable software, and 3) how to interpret findings.

HLTH 653 Quantitative Research Methods II in Public Health (3 credits)
Prerequisite: HLTH652. Restriction: Must be in a major within SPHL-Behavioral & Community Health department. Credit only granted for: HLTH653 or HLTH688T. Formerly: HLTH688T.
Intermediate and advanced statistics and procedures in health-related research for doctoral students with the focus on applications of these statistical methodological methods to public health research.

HLTH 665 Health Behavior I (3 credits)
The psychological, social psychological, and sociological theories of health behavior. The relation of health knowledge, beliefs, attitudes, intentions, and behavior to preventive, illness, sick-role, and health utilization behaviors.

HLTH 666 Health Behavior II (3 credits)
Prerequisite: HLTH665.
An advanced course with intensive training in health behavior research and the opportunity to carry out original research in health behavior. Patient-provider interaction, patient cooperation with medical treatment and other social

and psychological influences on health care.

HLTH 670 Public Health Informatics and Communications (3 credits)
Restriction: Must be in MPH: Community Health Education (Master's) program; or must be in Ph.D.: Public and Community Health (Doctoral) program. Credit only granted for: HLTH670 or HLTH688M. Formerly: HLTH688M.
Explores the use of current technology and communication techniques in the areas of public health research, planning, intervention and evaluation.

HLTH 671 Public Health Communication (3 credits)
Restriction: Non-SPH students must obtain permission from the instructor prior to registering. Credit only granted for: HLTH670 or HLTH671 and HLTH672. Formerly: HLTH670.
An exploration of the the broad and diverse field of health communication including medical encounters, everyday communication about health, advertising, news, public health campaigns, community outreach, public policy, and international programs. Theories and applied efforts that have been studied and documented will be examined.

HLTH 672 Public Health Informatics (3 credits)
Restriction: Instructor permission is required for students not enrolled in a degree seeking program in the School of Public Health. Also offered as: EPIB672. Credit only granted for: HLTH670 or HLTH671, HLTH672, EPIB 672. Formerly: HLTH670. Additional information: Course hashtag - #umdphi12.
A basic overview of Informatics and its application in a public health setting. The major goal is for students to understand the basic tools and building blocks needed to utilize this technology in order to improve their professional productivity

HLTH 688 Special Problems in Health Education (1-6 credits)

HLTH 710 Methods and Techniques of Research (3 credits)

HLTH 711 Advanced Research Methods in Health (3 credits)
Prerequisite: HLTH710. Restriction: Must be in MPH: Community Health Education (Master's) program; or must be in Ph.D.: Public and Community Health (Doctoral) program.
Quantitative techniques, advanced research methods and design issues.

HLTH 712 Applied Research Methods in Behavioral and Community Health (3 credits)
Prerequisite: HLTH710.
Designed to build on the research skills obtained in HLTH710 and other fundamental research methods and statistics courses. Methods and problems that are commonly encountered in health education research will be discussed including examination of actual research studies. Complex behavioral research issues will be addressed with existing research data sets. With these data sets, students will develop an analytic plan and conduct data analysis.

HLTH 742 Professional Writing and Presentations (3 credits)
Restriction: Must be in MPH: Community Health Education (Master's) program; or must be in Ph.D.: Public and Community Health (Doctoral) program. Credit only granted for: HLTH742 or HLTH688W. Formerly: HLTH688W.
Acquaints students with various types of professional writing required of public health professionals, including: grant proposals; journal articles; textbooks; presentation proposals and papers; and theses and dissertations. Includes both the form and content of technical documents as well as the processes of writing, peer review, and critique.

HLTH 774 Community Health Program Planning (3 credits)
Restriction: Must be in a major within SPHL-Behavioral & Community Health department; or permission of instructor. Credit only granted for: HLTH775 or HLTH774 and HLTH776. Formerly: HLTH775.
An introduction to the development, planning, and administration of community health programs. The overall goal of this course is to develop a program and conceptualize the implementation of the intervention.

HLTH 775 Health Education Program Planning and Evaluation (3 credits)
Prerequisite: HLTH710; and permission of SPHL-Behavioral & Community Health department.
A systematic approach to the planning and evaluation of Health Education programs. Diagnosis of the social, psychological, educational and administrative aspects of the health education program. Program monitoring, rigorous methods of impact assessment, and the measurement of efficiency.

HLTH 776 Community Health Program Evaluation (3 credits)
Prerequisite: HLTH710 and HLTH774. Restriction: Must be in a major within SPHL-Behavioral & Community Health department; or permission of instructor. Credit only granted for: HLTH775 or HLTH774 and HLTH776. Formerly: HLTH775.
An application of basic research methods, and the evaluation of community health programs. Students will evaluate the effectiveness of a community health intervention.

HLTH 780 Community Health (3 credits)
Credit only granted for: HLTH740 or HLTH780.
Overview of public health organizations, programs, and policies, including their structure and function, and their ability to change with changing community health needs.

HLTH 781 Advanced Theory and Applications in Health (1 credits)
Prerequisite: HLTH665 and HLTH710; and permission of SPHL-Behavioral & Community Health department. Credit only granted for: (HLTH781, HLTH782, and HLTH783) or HLTH688D. Formerly: HLTH688D.
Seminar course to examine theory-based public health research through small group discussion between faculty and students.

HLTH 782 Advanced Research Methods in Health (1 credits)
Prerequisite: HLTH781; and permission of SPHL-Behavioral & Community Health department. Credit only granted for: (HLTH781, HLTH782, and HLTH783) or HLTH688D. Formerly: HLTH688D.
Seminar course to examine theory-based public health research through small group discussion between faculty and students.

HLTH 783 Individual Research Plan in Health (1 credits)
Prerequisite: HLTH782; and permission of SPHL-Behavioral & Community Health department. Credit only granted for: (HLTH781, HLTH782, and HLTH783) or HLTH688D. Formerly: HLTH688D.
Seminar course to examine theory-based public health research through small group discussion between faculty and students.

HLTH 785 Internship in Public Health (3 credits)
Prerequisite: HLTH665, HLTH775, and HLTH780; or permission of SPHL-Behavioral & Community Health department.
Internship and seminar providing an opportunity to apply previously aquired knowledge and skills in a health or allied health organization. Setting of the internship will depend upon the student's background and career goals.

HLTH 786 Capstone Project in Public Health (3 credits)
Prerequisite: Must have completed all required coursework; and permission of SPHL-Behavioral & Community Health department. Restriction: Must be in a major within SPHL-Behavioral & Community Health department.
Capstone experience providing opportunity to apply knowledge and skills to a specific public health problem or issue. Completion of project relevant to public health under the direction of an advisor.

HLTH 799 Master's Thesis Research (1-6 credits)

HLTH 898 Pre-Candidacy Research (1-8 credits)

HLTH 899 Doctoral Dissertation Research (1-8 credits)

Immigration Studies (IMMR)

IMMR 400 Vital Voices: Oral Histories of the Immigrant Experience (3 credits)
Recommended: HIST222; or IMMR200. Credit only granted for: HIST428N or IMMR400. Formerly: HIST428N.
An exploration of the dynamic subject of U.S. immigrant experience through the scope of individual immigrant life stories in a global context. Course will include an overview of U.S. and global immigration patterns and an introduction to the practice of oral history.

IMMR 419 Special Topics in Immigration and Migration Studies (3 credits)
Repeatable to 6 credits if content differs.
Thematic exploration of a topic in immigration or migration studies history with emphasis on understanding how the movement of people is relevant in the contemporary world.

Information Management (INFM)

INFM 600 Information Environments (3 credits)
Role and function of information in organizations. Organizational environment and its influence on internal and external communication, organizational structure and management, organizational culture, information flow, organizational identity. Shared mental models and group decision ma king. Differences among types of organizations. Information policy.

INFM 603 Information Technology and Organizational Context (3 credits)
Restriction: Must not have completed LBSC671 or LBSC690; and permission of INFO-College of Information Studies.
Application of communication and information technologies to support work processes, including technology-enhanced communication networks, computer-supported collaborative work, decision-support systems, interactive systems, and systems analysis. Acquisition of information systems and their integration into the organization.

INFM 605 Users and Use Context (3 credits)
Use of information by individuals. Nature of information. Information behavior and mental models. Characteristics of problems, task analysis, problem solving, and decision making. Methods for determining information behavior and user needs. Information access. Information technology as a tool in information use.

INFM 612 Management of Information Programs and Services (3 credits)
Administration of information programs, services, and projects, including the role of leadership in management; developing mission, vision, and goals; providing effective management for results; managing professionals; financial management; and professional conduct and ethical issues.

INFM 620 Introduction to Strategic Information Management (3 credits)
Prerequisite: INFM612; or LBSC631; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Defining and identifying strategic information in an organization. Characteristics of strategic information management, including the principles, practices, issues, and programs involved with the strategic management and protection of information in organizations.

INFM 700 Information Architecture (3 credits)
Prerequisite: INFM603; or permission of instructor.
Principles and techniques of information organization and architecture for the Web environment. Structured description of digital resources, including data modeling techniques, metadata schemes, and user-oriented navigation systems.

INFM 711 Financial Management of Information Projects (3 credits)
Prerequisite: INFM600; and must have completed or be concurrently enrolled in INFM612.
Techniques and strategies of planning and executing successful projects. Project budgets, work breakdown structures and scheduling techniques, earned value, tracking and reporting project costs, risk management, best practices, and cost/benefit analysis.

INFM 714 Principles of Competitive Intelligence (3 credits)
Prerequisite: INFM600; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM714 or INFM718W. Formerly: INFM718W.
Intelligence process and how to build business advantage by the collection and analysis of the capabilities, vulnerabilities, market positioning and strategic planning of competitors using open source information.

INFM 718 Selected Topics in Information Management (1-3 credits)
Repeatable to 9 credits if content differs.
Selected topics in information management.

INFM 719 Independent Study (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Intensive individual study under faculty supervision.

INFM 727 Professional Opportunities for Information Managers (3 credits)
Prerequisite: INFM600, INFM603, and INFM605; or permission of instructor.
Roles and responsibilities of information managers, including information officers and others in charge of programs, to plan, coordinate, direct, or foster the systematic creation of information systems and services within an organization.

INFM 732 Information Audits and Environmental Scans (3 credits)
Prerequisite: INFM600; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM730, INFM731, or INFM732.
Techniques to assess the information needs of an organization to meet its strategic objectives. Methods of identifying information sources and gaps and of scanning the internal and external environment to identify changes that affect the organization. Application of information audits and environmental

scans in strategic information management.

INFM 735 Internship in Information Management (3 credits)
Prerequisite: INFM600, INFM603, INFM605, and INFM612; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Introduction to information management issues in the workplace, including the knowledge, skills, and experience necessary for success in high-impact information management positions. Securing and facilitating mentor relationships, and the development of actionable professional development plans.

INFM 736 Information Management Experience (3 credits)
Prerequisite: INFM600; and INFM612; and INFM605; and INFM603. Or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Information issues within organizational frameworks. Integrated experiential learning opportunity.

INFM 737 Information Management Capstone Experience (3 credits)
Prerequisite: INFM736; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Additional information: Taken near the end of student's program.
In-depth problem analysis and resolution. Capstone project.

INFM 743 Development of Internet Applications (3 credits)
Prerequisite: INFM603, LBSC690, LBSC671, or INST733; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Mark up languages and methods for manipulating marked-up content. Techniques for adding interactivity to web pages. Installing and running servers. Server-side applications. Application programming interfaces for third-party content and tools. Extension development.

INFM 747 Web-Enabled Databases (3 credits)
Prerequisite: INFM603, LBSC690, or LBSC671; and INST733. Or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM747 or INFM718N. Formerly: INFM718N.
Basic methods and tools for developing dynamic, database-driven web sites. Acquiring, installing, and running web servers, database servers, and connectability applications. Developing web interfaces and application-layer components.

INFM 750 From Data to Insights (3 credits)
Prerequisite: INFM603 and INST737; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM750.
Application of data science techniques to unstructured, real-world datasets including social media and geo-referenced sources. Techniques and approaches to extract information relevant for experts and non-experts in areas that include smart cities, public health, and disaster management.

INFM 757 Organizational and Business Process Modeling (3 credits)
Prerequisite: Must have completed at least 9 credits in the College of Information Studies. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM718V, INFM757. Formerly: INFM718V.
General principles of modeling, including methods for modeling organizational and business process for information applications and strategy development. Approaches to evaluating models based on their accuracy and usefulness.

INFM 799 Master's Thesis Research (1-6 credits)
Repeatable to 99 credits.

Information Studies (INST)

INST 603 Systems Analysis and Design (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST603, LBSC603, or INFM613. Formerly: INFM613
Formal process for planning and designing an information technology system, including identifying users and other stakeholders, analyzing work processes, preparing system specifications, conducting feasibility and usability studies, and preparing for implementation. Approaches to analyzing system components and functions. Measurement and evaluation of system performance.

INST 604 Introduction to Archives and Digital Curation (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC604 or LBSC605.
Overview of the principles, practices, and applications in the archival and digital curation fields.

INST 607 E-Government: Information, Communication, and Policy (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM718E, INST607, or LBSC708E. Formerly: INFM718E and LBSC708E.
Use of the Internet and other technologies by governments to provide information, communication, and services. Social, policy, and technological impacts on access and use, government-citizen interactions, digital divides. Roles of cultural institutions in supporting e-government access. Social media, collaborative, and enterepreneurial uses of e-government.

INST 610 Information Ethics (3 credits)
Credit only granted for: INFM718Q, INST610, or LBSC708I. Formerly: INFM718Q and LBSC708I.
Investigation of the diverse range of ehtical challanges facing society in the information age. Ethical theories, including non-Western and feminist theories. Application of theories to information ethics issues.

INST 611 Privacy and Security in a Networked World (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Evolving conceptualization of privacy and security issues in light of technological developments in the 21st century. Analysis of legal, ethical, design, and socially constructed challenges that organizations and individuals face when developing privacy and security solutions.

INST 612 Information Policy (3 credits)
Prerequisite: Permission of INFO-College of Information Studies. Credit only granted for: INST612 or LBSC625. Formerly: LBSC625.
Nature, structure, development and application of information policy. Interactions of social objectives, stakeholders, technology and other forces that shape policy decisions.

INST 613 Information and Human Rights (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST728B or INST613. Formerly: INST728B.
An examination of information as a human right, including topics: social, cultural, economic, legal, and political forces shaping information rights; the impact of information rights on information professions, standards, and cultural institutions; and information rights and disadvantaged populations.

INST 614 Information Literacy, Inclusion, and the Public Good (3 credits)
Restriction: Permission of INFO-College of Information Studies.
The educational and psychological dimensions of helping and supporting new users to become information literate and experienced users to remain engaged.

INST 621 Managing Digital Innovations in Organizations (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM718Z or INST621. Formerly: INFM 718Z.
Students will learn the main theoretical perspectives on managing digital innovations, become familiar with current best practices of innovating with IT, and develop innovation skills in various organizational settings such as project teams, functional departments, organizations, communities, and society at large.

INST 627 Data Analytics for Information Professionals (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Skills and knowledge needed to craft datasets, perform quantitative and qualitative analyses, and develop information resources that bridge the gap between raw data and decision makers' needs.

INST 630 Introduction to Programming for the Information Professional (3 credits)
Restriction: Permission of INFO-College of Information Studies.
An introduction to computer programming intended for students with no previous programming experience. Topics include fundamentals of programming and current trends in user interface implementation that are relevant to information professionals.

INST 632 Human-Computer Interaction Design Methods (3 credits)
Prerequisite: LBSC671 or INFM603; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Methods of user-centered design, including task analysis, low-tech prototyping, user interviews, usability testing, participatory design, and focus groups.

INST 633 Analyzing Social Networks and Social Media (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC708L or INST633. Formerly: LBSC708L.
Introduces students to the science and social science of network analysis. Through real world examples, including analysis of their own social networks, students will develop skills for describing and understanding the patterns and usage of services like Facebook, Twitter, YouTube, and others. Students will read classic and cutting edge articles and books about these topics and discuss their applicability to this new social media. The class will culminate with a capstone project in which students will apply the analysis methods they have learned to understanding a particular question about social networks and social media.

INST 640 Principles of Digital Curation (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Principles for the design and implementation of long-term curation of digital data and information assets, including born-digital and digitized assets. Frameworks for analysis of technical, practical, economic, legal, social and political factors affecting digital curation decisions. Case studies of specific digital curation scenarios.

INST 641 Policy and Ethics in Digital Curation (3 credits)
Prerequisite: INST640; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Discussion of strategies to address intellectual property, privacy, security and other policy and ethics concerns raised by the curation of digital records and data.

INST 643 Curation in Cultural Institutions (3 credits)
Restriction: Permission of INFO-College of Information Studies.
An overview of the principles, practices, and current debates in the management, care and representation of digital artifacts in libraries, archives, and museums.

INST 644 Introduction to Digital Humanities (3 credits)
Restriction: Permission of INFO-College of Information Studies.
A survey of the history, methods, and principal topics of the Digital Humanities, examined from theoretical and applied perspectives.

INST 645 Personal Digital Curation (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Discussion and workshop in selecting and preserving digital personal data and records.

INST 650 Facilitating Youth Learning in Formal and Informal Environments (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST650 or LBSC640.
The historical, organizational, and contemporary contexts of formal and informal learning spaces; the principles of teaching, learning, and information literacy that underlie the formal and informal learning spaces; and the leadership role that information professionals can play within their schools, libraries and communities.

INST 651 Promoting Rich Learning with Technology (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST651 or LBSC642. Formerly: LBSC642.
Exploration of how technology can be used to promote rich learning experiences, with a particular focus on youth populations. Assessment of the how, when, and why of infusing technology into the teaching and learning process.

INST 660 21st Century Leadership (3 credits)
Prerequisite: INFM612; or LBSC631; or LBSC635; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST660, LBSC708F or INFM718F. Formerly: LBSC708F, INFM718F.
Using a combination of research, literature and current practice, the course explores topics basic to the understanding and practice of leadership.

INST 680 Health Informatics (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in INFM600 or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST680 or INST728F. Formerly: INST728F.
An introduction to the ways in which medical data, information, and knowledge are created, stored and used. Students will gain an understanding of the current trends in the delivery of medical care and the ways in which these trends influence health information resources and systems.

INST 681 Health Information Behavior (3 credits)
Prerequisite: INFM600; or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Exploration of information needs of healthcare professionals and the general public, as well as how they seek

information to fulfill these information needs, impacts and outcomes of health-related information-seeking by multiple populations. Examination of models and theories and empirical studies of patient and healthcare professional information behavior.

INST 701 Introduction to Research Methods (3 credits)

Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC701, INFM718M or INST701. Formerly: LBSC701, INFM718M.

Techniques and strategies of research as applied to the definition, investigation, and evaluation of information problems. Qualitative, quantitative, and mixed methods of research design methods are considered from the aspects of implementation, analysis, and interpretation.

INST 702 Advanced Usability Testing (3 credits)

Prerequisite: Permission of instructor; or (INFM605 or INST631). Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM702 or INST702. Formerly: INFM702.

Usability testing methods -- how to design and implement them both for desktop and mobile sites. Students will learn the complex process of facilitating usability testing and how to synthesize test data into a report.

INST 706 Project Management (3 credits)

Prerequisite: INFM603 and INFM612; or (LBSC631 and LBSC671); or (LBSC635 and LBSC670); or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST706 or INFM706. Formerly: INFM706.

Comprehensive overview of project management, focusing on the needs of information resource (IR) projects. Concepts and techniques for planning and execution of projects including developing work breakdown structure, estimating costs, managing risks, scheduling, staff and resource allocation, team building, communication, monitoring, control, and other aspects of successful project completion.

INST 709 Independent Study (1-3 credits)

Prerequisite: Completion of all core courses. Restriction: Permission of INFO-College of Information Studies; and permission of instructor. Repeatable to 9 credits. Additional information: A student may complete no more than 9 credits registered under 709 or a total of 12 credits registered under 708 and 709.

Intensive individual study, reading, or research in an area of specialized interest under faculty supervision. Registration limited to the advanced student with the approval of the advisor and of the faculty member involved.

INST 714 Information for Decision-Making (3 credits)

Prerequisite: LBSC631 or INFM612; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM718A, INST714 or LBSC705. Formerly: INFM718A and LBSC705.

The use of information in organizational and individual decision-making. An examination of managers' behavior in using information; differences between the private and public sectors; and the roles of information professionals and information systems in decision-making.

INST 715 Knowledge Management (3 credits)

Prerequisite: LBSC631 or INFM603; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST715 or LBSC715. Formerly: LBSC715.

Nature, creation, acquisition, and use of knowledge. Strategic role of knowledge in organizations and institutions. Information and knowledge ecology. Structure and functions of knowledge management systems and the role of the Internet and intranets. Knowledge as intellectual capital. Roles of librarians and information professionals in the knowledge economy. Strategic issues and future trends.

INST 716 Information, Technology, and Society (3 credits)

Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST716, LBSC708T, or INFM718T. Formerly: LBSC708T and INFM718T.

An exploration of the mutually constitutive relationship between information technology (IT) and society, including how IT transforms society and how society transforms IT.

INST 717 Internship Practicum in Human-Computer Interactions (3 credits)

Prerequisite: INST631 and INST632. Recommended: INST701. Restriction: Permission of INFO-College of Information Studies; and must be in Human-Computer Interaction (Master's) program.

Required, supervised experience working in an industry, government, non-profit organization or an educational institution to address a problem in Human-Computer Interaction. Students will spend a minimum of 120 hours working in the agency during the internship.

INST 728 Special Topics in Information Studies (1-3 credits)

Restriction: Permission of INFO-College of Information Studies. Repeatable to 9 credits if content differs.

Selected topics in information studies.

INST 729 International Opportunities in Information Studies (3 credits)

Prerequisite: Permission of instructor. Restriction: Permission of INFO-College of Information Studies. Formerly: LBSC708S and LBSC729.

Short term, experiential course offered in conjuction with the University's Study Abroad Office, to volunteer, complete a project, or conduct research in a library or information organization outside the U.S. Focus and location varies.

INST 733 Database Design (3 credits)

Prerequisite: LBSC690, LBSC671, or INFM603; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST733 or LBSC793. Formerly: LBSC793.

Principles of user-oriented database design. Requirements analysis. Data modelling. Data integrity and security and multi-user databases. Implementing an information system using a database management system (DBMS).

INST 734 Information Retrieval Systems (3 credits)

Prerequisite: LBSC671 or INFM603; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST734 or LBSC796. Formerly: LBSC796.

Principles of organizing and providing access to information using automated information storage and retrieval systems. Retrieval systems models, index language selection, data structure, user interfaces, and evaluation for text and multimedia applications.

INST 735 Computational Linguistics I (3 credits)

Prerequisite: CMSC421; or students who have taken courses with comparable content may contact the department. Restriction: Permission of INFO-College of Information Studies. Also offered as: CMSC723, LING723. Credit only granted for: CMSC723, LING723, or INST735.

Fundamental methods in natural language processing. Topics include: finite-state methods, context-free and extended context-free models of syntax; parsing and semantics interpretation; n-gram and Hidden Markov models, part-of-speech tagging; natural language applications

such as machine translation, automatic summarization, and question answering.

INST 736 Computational Linguistics II (3 credits)
Prerequisite: LING723 or CMSC723; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Also offered as: CMSC773, LING773. Credit only granted for: INST736, INST728C, CMSC773, LING773, or LBSC774.
Natural language processing with a focus on corpus-based statistical techniques. Topics include: stochastic language modeling, smoothing, noisy channel models, probabilistic grammars and parsing; lexical acquisition, similarity-based methods, word sense disambiguation, statistical methods in NLP applications; system evaluation.

INST 737 Digging Into Data (3 credits)
Prerequisite: INST627; and (LBSC690, LBSC671, or INFM603). Or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
An exploration of some of the best and most general approaches to get the most information out of data through clustering, classification, and regression techniques.

INST 741 Social Computing Technologies and Applications (3 credits)
Prerequisite: INFM603 and INFM605; or (LBSC602 and LBSC671); or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INFM741 or INST741. Formerly: INFM741.
Tools and techniques for developing and configuring social computing applications. Theories and paradigms for social computing. Strengths and limitations of different application styles and types. Evolution of applications as responses to social computing challenges. Information and organizational systems co-development.

INST 742 Implementing the Curation and Management of Digital Assets (3 credits)
Prerequisite: INST640; or permission of instructor. Restriction: Election of the Digital Curation Specialization; and permission of INFO-College of Information Studies.
Management of and technology for application of digital curation principles in specific settings. Characteristics, representation, conversion, and preservation of digital objects. Application of standards for digitization, description, and preservation. Planning for sustainability, risk mitigation and disaster recovery.

INST 744 Solving Problems in Digital Curation - Capstone Course (3 credits)
Restriction: Must be enrolled in the Curation and Management of Digital Assets (CMDA) Certificate.
Project-based course that applies digital curation principles and techniques first-hand in an institutional program setting. The focus is on a well-defined project that constitutes a learning experience and also permits the student to contribute to the ongoing work of the host institution. The project must address one or more aspects of digital curation: design and implementation for long-term digital curation of a discrete collection; application of technologies and standards for digitization, description, and preservation of digital assets; or implementation of strategies to provide access to a digital collection.

INST 745 Introduction to Digital Arts Curation (3 credits)
Prerequisite: INST640; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Representation and curation of art artifacts through digital media, with a focus on how to collect and manage born-digital artifacts, digitized artifacts, and their related data and metadata.

INST 760 Data Visualization (3 credits)
Prerequisite: INST630; or INFM603; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: INST760 or INST728V. Formerly: INST728V.
Introduction to the science and technology of data visualization--the graphical representation of data to aid understanding--and includes both theoretical foundations as well as practical applications of integrated visualization techniques on real-world problems. Application of these techniques to state-of-the-art problem domains within research, society, and industry.

INST 767 Big Data Infrastructure (3 credits)
Prerequisite: INST737; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Principles and techniques of data science and business intelligence. Technologies and architectures for large-scale data warehousing and scale-out data analytics platforms. Supervised and unsupervised data mining.

INST 775 HCIM CAPSTONE PREP (3 credits)
Prerequisite: INST631, INST632, and INST717; and must have completed Research Methods; and permission of INFO-College of Information Studies. Or permission of instructor. Restriction: Must be taken in the fall semester of the year in which the student plans to graduate; and permission of INFO-College of Information Studies.
Students will define a project, which requires a high level of background research, rigor in execution and evaluation, and documentation. Capstone projects may follow the design, prototyping and evaluation process from end-to-end or may focus on a subset of elements in that process, such as formative study and design.

INST 776 HCIM CAPSTONE PROJECT (3 credits)
Prerequisite: INST775; or permission of instructor. Restriction: Must be taken in the semester immediately following completion of INST775 HCIM Capstone Prep; and permission of INFO-College of Information Studies.
The opportunity to apply the skills learned through coursework in a semester-long project applied to a real -world problem. Capstone projects may follow the design, prototyping and evaluation process from end-to-end or may focus on a subset of elements in that process, such as formative study and design.

INST 779 Readings Seminar (1 credits)
Prerequisite: Permission of instructor. Restriction: Permission of INFO-College of Information Studies. Repeatable to 3 credits if content differs. Credit only granted for: INST779, INST728J. Formerly: INST728J.
Readings in emerging topics. Through readings and discussion the class will critically assess future directions and highlight intersection points with other disciplines (e.g., medicine) and sub-disciplines of information studies and computer science (e.g., information retrieval, computer vision, machine learning). One or more themes will be covered over the semester (e.g., inclusive design, health informatics, environmental sustainability, social networking) and will be chosen based on instructor and student interest.

INST 790 Building the Human-Computer Interface (3 credits)
Prerequisite: Must have programming experience; or permission of INFO-College of Information Studies. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC790, INFM718B or INST790. Formerly: LBSC790 and INFM718B.
Principles and techniques for user interface implementation. Principles for building reliable large-scale interface components. Use of prototyping and rapid development tools. Techniques for managing user input and visual and auditory displays.

INST 799 Master's Thesis Research (1-6 credits)
Repeatable to 99 credits.

INST 800 The Engaged Intellectual: An Introduction to Research and Academic Work (3 credits)
Restriction: Permission of INFO-College of Information Studies; and restricted to students in Ph.D. in Information Studies (INFS) program.
An introduction to the academic life with a particular focus on what it means to undertake research, teaching, and service.

INST 808 Seminar in Research Methods and Data Analysis (3 credits)
Restriction: Permission of INFO-College of Information Studies. And must be in Information Studies (Doctoral) program; or permission of instructor. Repeatable to 9 credits if content differs. Credit only granted for: INST808, LBSC802, or INST802. Formerly: LBSC802, INST802.
Topics and issues in information studies research. Design and conduct of research project.

INST 809 Individualized Teaching Experience (3-5 credits)
Prerequisite: Must have completed 18 credit hours of doctoral course work. Restriction: Permission of INFO-College of Information Studies; and permission of instructor. Repeatable to 6 credits. Credit only granted for: INST809, LBSC774, INST728G. Formerly: INST728G.
Introduction to the techniques and challenges associated with design, delivery, and evaluation of couses offered at the University level. The doctoral student will work one-on-one with a faculty member in the development and co-teaching of a graduate level course.

INST 810 Individual Research Experience (3 credits)
Credit only granted for: INST810 or LBSC810. Formerly: LBSC810.
Pre-candidacy individual research experience directed by a faculty member.

INST 878 Special Topics in Information Studies (3 credits)
Restriction: Permission of INFO-College of Information Studies. And must be in Information Studies (Doctoral) program; or permission of instructor. Repeatable to 9 credits if content differs. Credit only granted for: INST878 or LBSC878. Formerly: LBSC878.
Seminar topics offered as faculty and student interests warrant. Topic varies.

INST 888 Doctoral Seminar (3 credits)
Restriction: Must be in Information Studies (Doctoral) program; and permission of INFO-College of Information Studies. Repeatable to 6 credits if content differs. Credit only granted for: INST888 or LBSC888. Formerly: LBSC888.
Advanced seminar on selected topics in information studies.

INST 898 Pre-Candidacy Research (1-8 credits)

INST 899 Doctoral Dissertation Research (1-8 credits)

Israel Studies (ISRL)

ISRL 448 Seminar in Israel Studies (3 credits)
Recommended: ISRL349 and ISRL249. Restriction: Must be in the Israel Studies Minor.
Intensive study of an Israel Studies topic. Expected work product is a substantial research or analysis paper or appropriate equivalent.

ISRL 449 Advanced Topics in Israel Studies (3 credits)
Recommended: ISRL349 or ISRL249. Repeatable to 6 credits if content differs.
Topics in the study of Zionism and contemporary Israel from the 1880s to the present at the advanced level. Individual sections may address history, politics, or culture. Some Sections may have language or course prerequisites.

ISRL 499 Advanced Independent Study in Israel Studies (1-3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 6 credits.
This upper-level independent study allows students to work closely with an Israel Studies faculty member of their choice, pending prior approval of the faculty member. In this independent study, students will focus on a topic specific to Israel Studies.

ISRL 618 Graduate Seminar in Israel Studies (3 credits)
Restriction: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
An exploration of aspects of the history, politics, society, or culture of Modern Israel. Topics will vary.

ISRL 628 Special Topics in Israeli History (3 credits)
Restriction: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
An exploration of aspects of the history of Modern Israel. Topics will vary.

ISRL 638 Special Topics in Israeli Politics (3 credits)
Restriction: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
An exploration of aspects of Israeli politics. Topics will vary.

ISRL 648 Special Topics in Israeli Society (3 credits)
Restriction: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
An exploration of aspects of Israeli society. Topics will vary.

ISRL 658 Special Topics in Israeli Culture (3 credits)
Restriction: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
An exploration of aspects of Israeli culture. Topics will vary.

ISRL 699 Independent Study in Israel Studies (3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
This graduate-level independent study allows graduate students to work closely with an Israel Studies faculty member of their choice, pending prior approval of the faculty member. In this independent study, graduate students will focus on a topic specific to Israel Studies.

Italian (ITAL)

ITAL 401 Advanced Composition and Style (3 credits)
Prerequisite: ITAL301; or students who have taken courses with comparable content may contact the department.
Advanced writing practice in range of genres.

ITAL 411 Dante in Translation (3 credits)
Dante's thought as expressed in his major writings: The Vita Nuova, De Monarchia and The Divine Comedy. Taught in English.

ITAL 421 The Italian Renaissance (3 credits)
Credit only granted for: ITAL421 or ITAL422.
A study of major trends of thought in Renaissance literature, art, and science. Taught in English.

ITAL 431 Italian Civilization in Translation (3 credits)
Credit only granted for: ITAL431 or ITAL432.
Political, social, intellectual, literary and artistic forces shaping contemporary Italy from the late Middle Ages to the present. Taught in English.

ITAL 433 Holocaust in Italian Literature and Cinema (3 credits)
Also offered as: FILM433. Credit only granted for: ITAL433 or FILM433 or (JWST419R in Fall 2008). Formerly: JWST419R in Fall 2008.
Review of literature and theoretical writings of Italy's most famous survivor, Primo Levi, to a sampling of Italian films that focus in vastly different and often extremely controversial ways on the experience of the concentration camp, while addressing a series of central questions from the brutal realities of the camps to the "compromises" made in order to survive, the need to bear witness, and the idea of the survivor's guilt.

ITAL 436 Italian Cinema I: Neorealism (3 credits)
Also offered as: FILM441. Credit only granted for: FILM441 or ITAL436.
Explores representations of Italy in cinema with special focus on identity formation and the movement of Italian neorealism and post neorealism. Taught in English.

ITAL 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

ITAL 471 Italian Cinema: A Cultural Approach in Translation (3 credits)
Credit only granted for: ITAL471 or ITAL472.
The culture of Italy through the medium of film from the silent days up to the present. Taught in English.

ITAL 473 Italian Cinema II - In Translation (3 credits)
Also offered as: FILM431. Credit only granted for: ITAL473, ITAL474, or FILM431.
A study of Italian society and culture through the medium of film from the mid 1970's to the present. Taught in English.

ITAL 475 The Italian Opera Libretto in English (3 credits)
Prerequisite: Must have completed one course in literature. Credit only granted for: ITAL475 or ITAL476.
History and analysis of Italian opera librettos from Monteverdi through Mozart to Verdi and Puccini. Taught in English.

ITAL 478 Colloquium in Italian (1 credits)
Prerequisite: ITAL311; or students who have taken courses with comparable content may contact the department. Corequisite: ITAL498, ITAL411, ITAL431, ITAL421, ITAL473, ITAL475, ITAL471, or ITAL499. Repeatable to 6 credits.
Colloquium section taught in Italian to accompany 400-level Italian courses taught in English. Discussion, presentations, readings.

ITAL 497 Senior Project (3 credits)
Prerequisite: 4 courses from ITAL400-499 course range; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Individual independent study of an aspect of Italian literature, culture or society selected according to student interest and need in consultation with a member of the Italian program.

ITAL 498 Special Topics in Italian Literature (3 credits)
Repeatable to 6 credits if content differs.

ITAL 499 Special Topics in Italian Studies (3 credits)
Repeatable to 6 credits if content differs.

Japanese (JAPN)

JAPN 401 Readings in Modern Japanese Literature (3 credits)
Prerequisite: Minimum grade of C- in JAPN302; or permission of instructor.
Development of advanced reading, vocabulary, grammar, and translation skills through selected readings in Japanese drawn primarily from modern literature.

JAPN 402 Readings in Japanese Cultural Studies (3 credits)
Prerequisite: Minimum grade of C- in JAPN302; or permission of instructor.
Development of advanced reading, vocabulary, grammar, and translation skills through selected readings in Japanese drawn from the fields of history, social sciences, cultural studies, film studies, and popular culture.

JAPN 403 Business Japanese: Practicum in Communicative Skills (3 credits)
Prerequisite: Minimum grade of C- in JAPN302; or permission of instructor.
Development of conversation, reading, and writing skills applicable to Japanese business transactions, official situations, and social meetings, with background material in English on professional business practices and social customs associated with business.

JAPN 404 Business Japanese: Readings and Applications (3 credits)
Prerequisite: Minimum grade of C- in JAPN302; or permission of instructor.
Focus on current readings pertaining to the Japanese corporate world from newspapers and other periodicals as well as online sources, and project-based development of oral and written skills in business Japanese.

JAPN 405 Readings in Advanced Modern Japanese (3 credits)
Prerequisite: JAPN402; or students who have taken courses with comparable content may contact the department; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Designed to further improve reading and translation skills; the course will include readings from newspaper articles, literary works, and academic publications in the social sciences and humanities. Listening exercises are included.

JAPN 406 Translating Diplomatic Japanese (3 credits)
Prerequisite: Minimum grade of C- in JAPN401; or permission of instructor.
Also offered as: JAPN606.
Formal, written, diplomatic Japanese to develop practical translation skills and to learn to use the computer as a telecommunications and translation workstation.

JAPN 407 The Art of Translation (3 credits)
Prerequisite: Minimum grade of C- in JAPN401; or students who have taken courses with comparable content may contact the department.
Theory and practice of translation. Variety of genres. Japanese to English.

JAPN 408 Special Topics in Japanese (3 credits)
Prerequisite: Minimum grade of C- in JAPN302; or permission of instructor.
Topic in the Study of Japanese, to be announced each time course is offered. Taught in Japanese.

JAPN 411 Introduction to Classical Japanese (3 credits)
Prerequisite: JAPN302; or students who have taken courses with comparable content may contact the department.
Classical Japanese grammar and the varied styles of classical Japanese. Readings in classical texts drawn from the Heian, Kamakura, Muromachi, and Edo periods.

JAPN 412 Classical Japanese (3 credits)
Prerequisite: JAPN411.
Continuation of JAPN 411 with more advanced classical Japanese.

JAPN 414 Masterpieces of Classical Japanese Literature in Translation (3 credits)
Major classics, with focus on philosophical, historical and cultural backgrounds. Taught in English.

JAPN 415 Modern Japanese Fiction in Translation (3 credits)
Major themes and literary developments in fiction from the late 19th century to the present. Emphasis on the works of Kawabata, Tanizaki, Mishima, and Abe.

JAPN 416 Japanese Women and Women Writers (3 credits)
Fiction and poetry by Japanese women from the Ninth Century to the present. Women's early role in creating and shaping a variety of literary genres, the silencing of women during the age of the shoguns, and the reemergence of a feminist tradition and women writers in the Twentieth Century. In English.

JAPN 418 Japanese Literature in Translation (3 credits)
Repeatable to 9 credits if content differs.
Representative works of Japanese literature in translation.

JAPN 421 History of the Japanese Language (3 credits)
Prerequisite: JAPN201; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Investigation of the origin of the Japanese language, its relationship with other languages, and its development. Taught in English, but presumes knowledge of Kanji (Chinese characters).

JAPN 422 Introductory Japanese Linguistics (3 credits)
An investigation of Japanese sound patterns and syntax through a comparison with English.

JAPN 424 Japan From the Margins (3 credits)
Credit only granted for: JAPN498B or JAPN424. Formerly: JAPN498B.
Additional information: Taught in English.
Japan from the Margins takes as its focus the history and representations of various others in Japanese society. They include ethnic Ainu, Okinawans, and Koreans, a historical outcaste group called the Burakumin, and people marginalized for their non-normative gender and sexual practices. Students learn about the historical specificities of each group as well as their common experiences of institutional discrimination as they grapple with larger questions regarding prejudice, nationalism, and social justice.

JAPN 425 The Atomic Bomb in Literature and Memory (3 credits)
Credit only granted for: JAPN498A or JAPN425. Formerly: JAPN498A.
Additional information: Taught in English.
Study of declassified documents and commentary on the United States decision to use the bomb in 1945, the many ways Japanese writers have attempted to express their indescribable experiences in Hiroshima and Nagasaki, and the shaping of historical narratives and national identities in post-war Japan and the U.S.

JAPN 428 Seminar in Japanese Discourse and Conversation Analysis (3 credits)
Prerequisite: JAPN302.
Recommended: JAPN422. Repeatable to 6 credits if content differs.
Presentation and discussion of classic and current readings in English and Japanese on theories and actual practice of discourse and conversation analysis. Students will learn transcription techniques and have an opportunity to apply them in a final term paper.

JAPN 438 Topics in Japanese Pragmatics (3 credits)
Prerequisite: JAPN201.
Recommended: JAPN422. Repeatable to 9 credits if content differs. Also offered as: JAPN638.
Basic concepts in the field of pragmatics (the study of language in context) such as deixis and indexicality, speech acts, ellipsis, and politeness. Readings in English on English and Japanese examples.

JAPN 498 Special Topics in Japanese Studies (3 credits)
Special topics in Japanese studies. Taught in English.

JAPN 499 Directed Study in Japanese (1-3 credits)
Prerequisite: Permission of instructor.
Repeatable to 6 credits if content differs.

JAPN 606 Practicum in Translation: Diplomatic Japanese (3 credits)
Prerequisite: JAPN402; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor. Also offered as: JAPN406.
Credit only granted for: JAPN406 or JAPN606.
Formal, written, diplomatic Japanese to develop practical translation skills and to learn to use the computer as a telecommunications and translation workstation.

JAPN 608 Readings in Advanced Modern Japanese (3 credits)
Prerequisite: JAPN402; or students who have taken courses with comparable content may contact the department; or permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
To improve reading and translation skills; readings from newspaper articles, literary works, and academic publications in the social sciences and humanities. Listening exercises are included.

JAPN 619 Topics in Modern Japanese Literature in Translation (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 9 credits if content differs.
Current topics in modern Japanese literature in English translation.

JAPN 628 Seminar in Japanese Discourse and Conversation Analysis (3 credits)
Prerequisite: JAPN302.
Recommended: JAPN422. Repeatable to 6 credits if content differs.
Presentation and discussion of classic and current readings in English and Japanese on theories and actual practice of discourse and conversation analysis. Students will learn transcription techniques and have an opportunity to apply them in a final term paper.

JAPN 638 Topics in Japanese Pragmatics (3 credits)
Prerequisite: JAPN201. Repeatable to 9 credits if content differs. Also offered as: JAPN438.
Basic concepts in the field of pragmatics.

JAPN 679 Special Topics in Japanese Linguistics (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 9 credits if content differs.

Current topics in research in Japanese linguistics.

Journalism (JOUR)

JOUR 400 Media Law (3 credits)

Prerequisite: JOUR320, JOUR360, or JOUR501. Restriction: Junior standing or higher.

Legal rights and constraints of mass media; libel, privacy, copyright, monopoly, contempt, and other aspects of the law applied to mass communication. Previous study of the law not required.

JOUR 434 Salzburg Seminar: Global Media Literacy (3 credits)

Restriction: Must be in Salzburg Academy program. Also offered as: JOUR734. Credit only granted for: JOUR434 or JOUR734.

An advanced analysis of the information, values underlying messages conveyed via television, newspapers, the Internet, magazines, radio and film from a cross-cultural perspective. Examines the accuracy of messages and explores how distinctive global media shape views of politics culture and society with nations, across regions and internationally.

JOUR 435 Salzburg Seminar: Global Change, Global Cooperation (3 credits)

Restriction: Must be in Salzburg Academy program. Also offered as: JOUR735. Credit only granted for: JOUR435 or JOUR735.

Practical and theoretical examination of a global problem (or problems) of contemporary importance from a cross-cultural, perspective. Analytical framework used to examine how media shape global problems, events and/or issues regionally.

JOUR 451 Advertising and Society (3 credits)

Restriction: Junior standing or higher.

Advertising as an institution with manifest economic purposes and latent social effects. Influences of advertising on people, and related issues of ethics and social responsibility.

JOUR 452 Women in the Media (3 credits)

Restriction: Junior standing or higher. Also offered as: WMST452. Credit only granted for: JOUR452 or WMST452.

Participation and portrayal of women in the mass media from colonial to contemporary times.

JOUR 453 News Coverage of Racial Issues (3 credits)

Restriction: Junior standing or higher.

Analysis of news media coverage of issues relating to racial minorities in the United States, with special attention to Hispanics, Asian Americans, African Americans and Native Americans.

JOUR 455 Media Entrepreneurship (3 credits)

Credit only granted for: JOUR459E or JOUR455. Formerly: JOUR459E.

Basic business and entrepreneurship concepts will be covered and will explore how technology is transforming the business of media. Students develop and pitch ideas for media businesses, learn startup basics, do exercises in Internet advertising and business plan analysis, use social networks and other digital communication tools, and perform other hands-on exercises in business development and presentation.

JOUR 456 Literature in Journalism (3 credits)

Also offered as: JOUR673. Credit only granted for: JOUR456 or JOUR673.

From Truman Capote's In Cold Blood to Mark Bowden's Black Hawk Down, students will examine how literary works can help writers approach a subject in a different way than more traditional forms of journalism, including the advantages and limitations of the style.

JOUR 458 Special Topics in Journalism (3 credits)

Repeatable to 6 credits if content differs.

Issues of special concerns and current interest.

JOUR 459 Special Topics in Journalism (1-3 credits)

Repeatable to 6 credits if content differs.

Issues of special concern and current interest. Open to all students.

JOUR 462 Professional Seminar in Public Affairs Reporting (3 credits)

Prerequisite: Permission of JOUR-Philip Merrill College of Journalism.

Explore theoretical and practical issues in the press coverage of governments. Examine the complex press-government relationship.

JOUR 470 Journalism and Public Communication Research (3 credits)

Prerequisite: Must have completed a university statistics course. Credit only granted for: JOUR470 or JOUR477. Formerly: JOUR477.

Journalism and public communication research methods used in measuring public opinion and media programs and materials.

JOUR 471 Public Opinion Research (3 credits)

Prerequisite: Must have completed a university statistics course.

Measurement of public opinion and media habits; role of the media in the formation of public opinion.

JOUR 472 Computer-Assisted Reporting (3 credits)

Prerequisite: JOUR320 or JOUR360.

Computer and online data acquisition; analytical methods for writing and reporting news.

JOUR 476 Researching Emerging Media in Journalism: Past, Present and Future (3 credits)

Prerequisite: Must have completed a university statistics course. Credit only granted for: JOUR479W or JOUR476. Formerly: JOUR479W.

Students will examine developments billed as innovative in the current technology-laden news ecology -- such as social networking, mobile reporting and computational journalism -- and the blurring of lines between hard news, informed opinion and advocacy. While questions about the future cannot be answered with any certainty, an exploration of the past allows us to see what happened when new technologies, information systems and practices appeared as possible tools for use by journalists and the communities they served. Students will learn to use tools for researching emerging media, including UMD library databases and open access databases. The course will include presentations by the instructor, discussions based on class readings, in-class exercises in small groups and student presentations. Each student will engage in a "Decades" research project.

JOUR 479 Special Topics in Data Gathering and Analysis (1-3 credits)

Repeatable to 3 credits.

Special research topics for reporting and writing.

JOUR 480 Capstone Colloquium: The Business of News (1 credits)

Restriction: Must be in a major in JOUR-Philip Merrill College of Journalism; and junior standing or higher; and permission of JOUR-Philip Merrill College of Journalism.

Students will learn the basic news business concepts and examine how revenue and cost structures for media businesses are evolving in new directions. Topics include basic principles and concepts that drive media businesses in the Internet age, including revenue sources, dynamics of online advertising and subscriptions, mobile media strategies, user metrics, engaging audiences, and market dynamics.

JOUR 501 Fundamentals of Writing and Editing (3 credits)
Prerequisite: Permission of JOUR-Philip Merrill College of Journalism.
Principles of news and feature writing. For graduate students with limited prior training or experience in journalism.

JOUR 503 Reporting for Broadcast News (3 credits)
Prerequisite: JOUR501. Also offered as: JOUR262. Credit only granted for: JOUR262 or JOUR503.
Training in gathering and producing news for radio and television newcasts.

JOUR 504 Introduction to Multimedia Skills (3 credits)
Corequisite: JOUR501; or permission of instructor. Restriction: Permission of JOUR-Philip Merrill College of Journalism. Credit only granted for: JOUR504 or JOUR628G. Formerly: JOUR628G.
Examining the basics of producing and editing digital photos, video, and audio. Topics include: framing, lighting, and other aspects of composition; sequencing, using wide, medium, and tight shots; and ethical considerations when collecting sound and visuals.

JOUR 600 Journalism Ethics (3 credits)
Prerequisite: Permission of JOUR-Philip Merrill College of Journalism.
Examination of ethical problems in journalism and the media industry.

JOUR 601 Theories of Journalism and Public Communication (3 credits)
Prerequisite: Permission of JOUR-Philip Merrill College of Journalism.
Survey and evaluation of current communication theories. Attention is given to the nature and function of scientific theory, models of communication behavior, the nature of information, social functions of journalism and public communication, attitude change and persuasive communication and theories of language and meaning.

JOUR 603 News Videography (3 credits)
Prerequisite: JOUR504; and permission of Journalism College required. Restriction: Permission of JOUR-Philip Merrill College of Journalism. Also offered as: JOUR262. Credit only granted for: JOUR503 or JOUR603. Formerly: JOUR503.
Introduction to shooting, editing and production of video stories for broadcast and the Web; includes newsgathering in the field.

JOUR 604 Introduction to Multimedia Skills for Graduate Certificate Programs (3 credits)
Restriction: Permission of JOUR-Philip Merrill College of Journalism; and must not have completed JOUR504. Credit only granted for: JOUR 604, JOUR504, or JOUR628G. Formerly: JOUR628G. Additional information: This course is for students enrolled in graduate certificate programs in the College of Journalism.
Examine the basics of producing and editing digital photos, video and audio for news. Topics include framing, lighting and other aspects of composition; sequencing, using wide, medium and tight shots; and ethical considerations when collecting sound and visuals.

JOUR 610 Seminar in Mass Media History (3 credits)
Credit only granted for: JOUR610 or JOUR710. Formerly: JOUR710.
Analysis and discussion of the interrelationships between the mass media and society, including various social and cultural elements of modern society; responsibilities of the mass media and the mass communicator.

JOUR 620 Public Affairs Reporting (3 credits)
Prerequisite: JOUR501; or permission of JOUR-Philip Merrill College of Journalism.
Designed to add to and sharpen the skills learned in JOUR501. It is primarily an introduction to "beat" reporting that allows students to sample the most common new beats while reporting and writing on deadline. Students are required to develop and hone their multimedia skills by reporting in a variety of media.

JOUR 623 Mobile Journalism (3 credits)
Prerequisite: Students must have basic computer skills. Credit only granted for: JOUR689M or JOUR623. Formerly: JOUR689M.
A review of several mobile applications and the "hands-on" skills needed to collect and share news in the field. First, students learn how to remotely post information to blogs and social networks. Students then learn and practice the latest location-based production techniques using web services on wireless laptops and mobile devices. Students use laptops (and their own "SmartPhone") to record, edit and upload audio and video.

JOUR 624 Commentary and Editorial Writing (3 credits)
Credit only granted for: JOUR624 or JOUR628N. Formerly: JOUR628N.
Journalistic interpretation and analysis; commentary and editorial writing.

JOUR 625 Advanced Capital News Service Bureau (6 credits)
Prerequisite: JOUR620; and permission of JOUR-Philip Merrill College of Journalism. Credit only granted for: JOUR625 or JOUR729. Formerly: JOUR729.
Advanced journalism training. Students report as part of College's Capital News Service program.

JOUR 627 Urban Affairs Reporting (3 credits)
Prerequisite: JOUR501; and permission of JOUR-Philip Merrill College of Journalism. Corequisite: JOUR620; or permission of JOUR-Philip Merrill College of Journalism. Also offered as: JOUR327. Credit only granted for: JOUR327 or JOUR627.
Students are immersed in coverage of issues affecting cities, working on a semester-long multi-platform reporting project based in Baltimore.

JOUR 628 Specialized Topics in News Writing and Reporting (1-3 credits)
Credit only granted for: JOUR628 or JOUR728. Formerly: JOUR728.
Advanced training and practice in writing and reporting news. Repeatable to a maximum of six credits provided the content differs.

JOUR 640 Seminar in Advertising Communication (3 credits)
Credit only granted for: JOUR640 and JOUR740. Formerly: JOUR740.
Role of advertising as a form of public communication in American society. Advertising and the firm; advertising and the economy; advertising and the individual; advertising and consumerism; advertising and the media.

JOUR 652 Interactive Design and Development (3 credits)
Corequisite: Offered to students enrolled in the journalism master's degree or certificate.
Conceptualize, wireframe, design and build responsive Web pages using html, style sheets and other coding tools; work with open source interactive tools and javascript libraries to create charts, timelines and maps to tell stories.

JOUR 654 Advanced Interactive Multimedia Storytelling (3 credits)
Prerequisite: JOUR652; and permission of JOUR-Philip Merrill College of Journalism.
Learning and applying Flash and/or other interactive tools to assemble multiple media (i.e. graphics, video, etc.) to create interactive narratives.

JOUR 655 Advanced Online News Bureau (6 credits)
Prerequisite: JOUR603 or JOUR620; and (JOUR504 and JOUR652). Or

permission of JOUR-Philip Merrill College of Journalism.
Advanced online journalism training. Students work as online reporters, editors and producers for a news site. Students also package copy from the print and broadcast news bureaus.

JOUR 656 Advanced Kaiser Health Multimedia Reporting (3 credits)
Prerequisite: JOUR504. Corequisite: JOUR620 or JOUR503. Restriction: Permission of instructor.
Advanced reporting on health topics, using traditional and multimedia storytelling tools.

JOUR 660 Broadcast News Writing (3 credits)
Prerequisite: JOUR501. Credit only granted for: JOUR660 or JOUR760. Formerly: JOUR760.
Descriptive and critical analysis of broadcast news; methods of evaluation of news judgments; decision-making and organizational aspects of the broadcast news industry.

JOUR 661 Television Reporting and Production (3 credits)
Prerequisite: JOUR603; or students who have taken courses with comparable content may contact the department. Restriction: Must not be in Journalism Studies (Doctoral) program.
Reporting, writing, editing and production of broadcast news.

JOUR 662 Broadcast News Producing (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in JOUR661; and (JOUR603 and JOUR660). Also offered as: JOUR362. Credit only granted for: JOUR668B or JOUR662. Formerly: JOUR668B.
Learn and practice the basics of broadcast newscast producing. Design, write, edit and implement a news program.

JOUR 663 Long Form Broadcast Journalism (3 credits)
Prerequisite: JOUR503 or JOUR603; and JOUR661. Or students who have taken courses with comparable content may contact the department. Also offered as: JOUR363. Credit only granted for: JOUR363, JOUR486, or JOUR663. Formerly: JOUR486.
Productions of long form broadcast news reporting, reality videos or documentaries.

JOUR 664 Radio Broadcasting (3 credits)
Prerequisite: JOUR501 and JOUR603; or permission of JOUR-Philip Merrill College of Journalism. Restriction: Permission of JOUR-Philip Merrill College of Journalism.
Students apply news reporting skills to prepare and produce a weekly radio news magazine program.

JOUR 665 Patch U:Hyper-Local News Production (3 credits)
Prerequisite: JOUR501 and JOUR504; or permission of JOUR-Philip Merrill College of Journalism. Corequisite: JOUR620 and JOUR652; or permission of JOUR-Philip Merrill College of Journalism. Restriction: Permission of JOUR-Philip Merrill College of Journalism. Also offered as: JOUR337. Credit only granted for: JOUR389P, JOUR337 or JOUR665.
Patch U: Hyper Local News Production for graduate students.

JOUR 667 Broadcast News Bureau (6 credits)
Prerequisite: JOUR503; or students who have taken courses with comparable content may contact the department. And permission of JOUR-Philip Merrill College of Journalism.
Advanced broadcast journalism training. Students report as part of the College's Capital News Service program.

JOUR 668 Topics in Broadcasting and Electronic Media (1-3 credits)
Repeatable to 6 credits if content differs. Credit only granted for: JOUR668 or JOUR768. Formerly: JOUR768.
Advance research and analysis of selected topics in broadcast journalism.

JOUR 670 Photojournalism (3 credits)
Prerequisite: JOUR504. Restriction: Must be in a major in JOUR-Philip Merrill College of Journalism; and permission of JOUR-Philip Merrill College of Journalism. Credit only granted for: JOUR 368P, JOUR 370 or JOUR 670. Additional information: Students are required to borrow, rent or purchase a 35mm digital camera. Contact department for camera specifications.
Examining the basics of shooting, editing and storytelling with still photos taken with 35mm digital cameras. Students shoot portraits, feature photos and action shots. Final project is a photo story/essay.

JOUR 672 Writing the Complex Story (3 credits)
Credit only granted for: JOUR662 or JOUR672. Formerly: JOUR622.
Advanced writing, focusing on the strategies and techniques of modern explanatory journalism.

JOUR 673 Literature in Journalism (3 credits)
Also offered as: JOUR456. Credit only granted for: JOUR456 or JOUR673.
From Truman Capote's In Cold Blood to Mark Bowden's Black Hawk Down, students will examine how literary works can help writers approach a subject in a different way than more traditional forms of journalism, including the advantages and limitations of the style.

JOUR 677 Literary Journalism (3 credits)
Credit only granted for: JOUR377, JOUR487, or JOUR677.
Practice in the use of literary techniques and especially of dramatic structure in modern newspaper series, magazine pieces and books. Analysis, researching and writing of nonfiction stories, usually with a focus on a specialized area chosen by the student.

JOUR 680 Science Communication (3 credits)
Advanced professional training in science reporting and writing for the mass media and in technical communication to specialized audiences. Communication behaviors of scientists and audiences. Application of communication theory and the history and philosophy of science to science writing.

JOUR 681 Media Industry Reporting (3 credits)
Prerequisite: JOUR501; or permission of JOUR-Philip Merrill College of Journalism. Corequisite: JOUR620; or permission of JOUR-Philip Merrill College of Journalism. Restriction: Permission of JOUR-Philip Merrill College of Journalism. Also offered as: JOUR381. Credit only granted for: JOUR381 or JOUR681.
Students hone their reporting and writing skills as they produce work for the Web site of an award-winning professional publication, and immerse themselves in the news industry, which is undergoing dramatic transformation in the digital age.

JOUR 685 Visual Storytelling (3 credits)
Also offered as: JOUR385. Credit only granted for: JOUR385 or JOUR685.
Students will practice and refine their own visual storytelling skills.

JOUR 689 News Coverage of Specialized Topics (1-3 credits)
Prerequisite: JOUR620; or JOUR660. Repeatable to 6 credits if content differs.
Advance training and practice in writing and reporting news in on specialized field of interest.

JOUR 698 Special Problems in Communication (1-3 credits)
Repeatable to 6 credits.

Independent study in area of the student's interest.

JOUR 700 Seminar in Media Law (3 credits)
Restriction: Must be in one of the following programs (Journalism - Master (Master's); Journalism Studies (Doctoral)) ; or permission of JOUR-Philip Merrill College of Journalism. Credit only granted for: JOUR400, JOUR700, or JOUR755. Formerly: JOUR755.
Legal rights and constraints of mass media; libel, privacy, copyright, monopoly, and contempt, and other aspects of the law applied to mass communication.

JOUR 702 Journalism Law and Ethics (3 credits)
Restriction: Must be in one of the following programs (Journalism - Master (Master's); Journalism Studies (Doctoral)) ; or permission of JOUR-Philip Merrill College of Journalism. Credit only granted for: JOUR400, JOUR 600, JOUR700, or JOUR 702.
An examination of the legal rights and ethical problems and constraints of mass media, including libel, privacy, copyright, monopoly and contempt.

JOUR 716 History of Investigative Journalism (3 credits)
Restriction: Permission of instructor.
Graduate students will learn the history of investigative journalism in the U.S., focusing on key time periods from colonial times to the present.

JOUR 722 Mediacentric Politics (3 credits)
Prerequisite: JOUR601.
Examination of the growing use of the media image and issues in electorial politics and interest-group advocacy.

JOUR 725 Political Communication (3 credits)
Prerequisite: JOUR601 or JOUR801.
Critical examination of the interplay between the media, government and the political process.

JOUR 729 Reporting from Annapolis and Washington (6 credits)
Repeatable to 12 credits if content differs.
Advanced training in public affairs journalism. Students report state and federal news as part of College's Capital News Service.

JOUR 730 Seminar in Comparative Mass Communication (3 credits)

JOUR 734 Salzburg Seminar: Global Media Literacy (3 credits)
Restriction: Must be in Salzburg Academy program. Also offered as: JOUR434. Credit only granted for: JOUR434 or JOUR734.
An advanced analysis of the information, values and underlying messages conveyed via television, newspapers, the Internet, magazines, radio and film from a cross-cultural perspective. Examines the accuracy of messages and explores how distinctive global media shape view of politics, culture and society within nations, across regions and internationally.

JOUR 735 Salzburg Seminar: Global Change, Global Cooperation (3 credits)
Restriction: Must be in Salzburg Academy program. Also offered as: JOUR435. Credit only granted for: JOUR435 or JOUR735.
Practical and theoretical examination of a global problem (or problems) of contemporary importance from a cross-cultural, perspective. Analytical framework used to examine how media shape global problems, events and/or issues regionally.

JOUR 738 Topics in International and Cross-Cultural Communication (3 credits)
Repeatable to 6 credits if content differs.
Specialized topics in the fields of comparative journalism and mass communications and in the field of cross-cultural communication.

JOUR 762 Professional Seminar in Public Affairs Reporting (3 credits)
Prerequisite: JOUR620; and permission of JOUR-Philip Merrill College of Journalism. Restriction: Must not have completed JOUR462.
Examination of theoretical and practical issues in the press coverage on government and public affairs.

JOUR 763 Seminar in Newsroom Management (3 credits)
Credit only granted for: JOUR481, JOUR675, or JOUR763. Formerly: JOUR675.
Organization, operation, and administration of the departments of a newsroom: advertising, business-finance, circulation, news-editorial, personnel, production and promotion.

JOUR 767 New Media Technologies (3 credits)
Selected survey of theories of technology and communication with special attention to issues concerning the use of computer technology as a communication medium.

JOUR 772 Methods in Computer-Assisted Reporting (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in JOUR501; or students who have taken courses with comparable content may contact the department.
Computer-assisted (database) journalism; obtaining, manipulating and analyzing complex government data for journalism projects.

JOUR 775 Quantitative Methods in Journalism and Public Communication Research (3 credits)
Credit only granted for: JOUR701 or JOUR775. Formerly: JOUR701.
Logic and methods of quantitative data collection and statistical analysis as applied to journalism and public communication studies.

JOUR 776 Qualitative Research Methods in Journalism and Public Communication (3 credits)
Credit only granted for: JOUR711 or JOUR776. Formerly: JOUR711.
Methods of historical, critical and field research in journalism and public communication. Formulation of significant research questions, systematic collection of bibliographic and phenomenal information, formulating substanial claims, organizing and writing research for disciplinary outlets.

JOUR 777 Advanced Historical/Critical Methods in Journalism and Public Communication (3 credits)
Credit only granted for: JOUR712 or JOUR777. Formerly: JOUR712.
Critical assessment of qualitative approaches to public communication. Introduction to significant schools of historical and critical research. Advanced techniques for inquiry and manuscript preparation. Students must have a dissertation research project requiring historical or critical theory.

JOUR 779 Seminar in Research Problems (1-3 credits)
Repeatable to 6 credits if content differs. Credit only granted for: JOUR779 or JOUR780. Formerly: JOUR780.
Methods of research design and analysis in specialized areas of journalism and public communication research.

JOUR 798 Master's Professional Fieldwork (1-6 credits)
Repeatable to 6 credits.
Research for and preparation of news articles or programs for use in the media. Analysis of fieldwork experience using

communication theory and research results. Fieldwork may be done independently or as an internship. Repeatable to a maximum of six credits.

JOUR 799 Master's Thesis Research (1-6 credits)

JOUR 800 Introduction to Doctoral Study in Journalism and Public Communication (3 credits)
Credit only granted for: JOUR700 or JOUR800. Formerly: JOUR700.
Basic skills in journalism and public communication research.

JOUR 801 Advanced Public Communication Theory (3 credits)
Prerequisite: JOUR601; or students who have taken courses with comparable content may contact the department. Credit only granted for: JOUR601 or JOUR801.
Advanced selected survey of communication & media theory.

JOUR 808 Doctoral Colloquium (1-3 credits)
Prerequisite: Must have completed or be concurrently enrolled in JOUR800. Repeatable to 4 credits if content differs.
Guided discussion of professional and theoretical topics.

JOUR 818 Seminar in Communication Theories and Journalism Practice (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in JOUR800. Repeatable to 6 credits if content differs.
Critical examination of existing theory and/or journalism practices suggesting hypotheses and formulating proposals for future research.

JOUR 888 Doctoral Professional Field Work (1-9 credits)
Repeatable to 9 credits if content differs. Formerly: PCOM888.
Critical analysis of a phase of a professional field in journalism and public communication. Analysis of professional activity through personal observation. Evaluation of the purpose, process, effectiveness, and efficiency of professional activity. Recommendations for training and further research.

JOUR 889 Doctoral Tutorial in Journalism and Public Communication (1-9 credits)
Repeatable to 9 credits if content differs. Formerly: PCOM889.
Individual research in journalism and public communication.

JOUR 898 Pre-Candidacy Research (1-8 credits)

JOUR 899 Doctoral Dissertation Research in Journalism and Mass Communication (1-8 credits)
Formerly: PCOM899.

Jewish Studies (JWST)

JWST 408 Honors Seminar in Jewish Studies (3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Restriction: Junior standing or higher.
An in-depth exploration of a theme in Jewish history, literature, culture or thought. Course subject and readings will vary from year to year, but will generally cut across periods, locations, or disciplines. Students are expected to engage the course material critically and to use the seminar as an opportunity to develop an independent research agenda.

JWST 409 Research Seminar in Jewish Studies (3-4 credits)
Prerequisite: Must have completed two upper-level courses in an appropriate area of Jewish Studies; or permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 9 credits if content differs. Formerly: JWST309.
A capstone course for Jewish Studies. Guides students through advanced source material and subject matter, research skills, and presentation techniques. A substantive paper based on independent research and analysis is one expected outcome.

JWST 419 Special Topics in Jewish Studies (3 credits)
Repeatable to 9 credits if content differs.

JWST 429 Advanced Topics in Jewish Studies (3-4 credits)
Repeatable to 12 credits if content differs.
Special topics at an advanced level for Jewish Studies. Primarily intended for majors and graduate students.

JWST 430 Dead Sea Scrolls (3 credits)
Prerequisite: Must have completed one JWST course or one RELS course; or permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Also offered as: RELS430. Credit only granted for: JWST429Q, JWST430, RELS419Q,or RELS430. Formerly: JWST429Q.
A study of the Dead Sea Scrolls in their ancient and modern settings, and in terms of contemporary scholarly interpretations of their meaning. Interpretations of the historical significance of these documents, their connections to ancient Jewish sectarian movements, and their implications for our understanding of Judaism, Christianity, and the history of the Bible.

JWST 432 Jews in Medieval Times 1000-1450 (3 credits)
Recommended: HIST282, JWST234, HIST330, or HIST331. Also offered as: HIST476. Credit only granted for: HIST419R, HIST476, or JWST432. Formerly: JWST429M.
Social and cultural life of Jewish communities spread throughout Islam and Christendom. Major topics include the Gaonate; kehila organization; legal, rationalist, and mystical thought; and the context of rising animosity linked to the Crusades and changing Church doctrines.

JWST 451 Issues in Jewish Ethics and Law (3 credits)
Prerequisite: Must have completed 3 credits in philosophy or Jewish studies (excluding Hebrew language); or permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Credit only granted for: JWST451, or PHIL433.
Philosophical and meta-legal questions concerning the nature of Jewish law and its relation to morality.

JWST 452 The Golden Age of Jewish Philosophy (3 credits)
Prerequisite: 3 credits in PHIL courses; or permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Restriction: Must not have completed PHIL417. Also offered as: PHIL417. Credit only granted for: JWST452 or PHIL417.
Jewish philosophy from Maimonides in the 12th Century to the expulsion of the Jews from Spain at the end of the 15th Century. Topics include the limitations of human knowledge, creation of the world, foreknowledge and free will, and the existence of God.

JWST 453 Philosophy of Spinoza (3 credits)
Prerequisite: 6 credits in PHIL courses; or permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Restriction: Must not have completed PHIL424. Also offered as: PHIL424. Credit only granted for: JWST453 or PHIL424.
An investigation of the metaphysical, ethical, and political thought of the 17th century philosopher Benedict Spinoza.

JWST 459 Readings in Medieval Hebrew (3-4 credits)

Repeatable to 9 credits if content differs. Credit only granted for: JWST459 or JWST466. Formerly: JWST466.
Readings and analysis of Hebrew texts and literature from the Middle Ages. Language of instruction in English; all texts in Hebrew.

JWST 468 Readings in the Hebrew Bible (3-4 credits)
Prerequisite: HEBR313; or permission of instructor. Repeatable to 9 credits if content differs. Formerly: HEBR441 and HEBR442.
Readings in the Hebrew text of the Bible. Emphasis in close reading, grammar analysis, and modern interpretations of the Bible. Language of instruction English; all texts in Hebrew.

JWST 469 Readings in Rabbinic Hebrew (3-4 credits)
Prerequisite: HEBR313; or permission of instructor. Repeatable to 9 credits if content differs.
Readings in classical rabbinic texts and related corpora. Emphasis on grammar and reading skills as well as critical analysis of the material. Language of instruction: English; all texts in original language.

JWST 471 Modern Hebrew Literature in Translation (3 credits)
An exploration of modern Hebrew prose, poetry, and literary essays written from the 1880s through the present in Europe, Palestine, and Israel. An investigation of the challenges confronting authors such as Mendele Mokher Sforim, Avraham Mapu, Chaim Nahman Bialik, Dvorah Baron, S.Y. Agnon, and David Fogel as they tried to create a contemporary secular literature out of an ancient sacred language. All texts in English translation.

JWST 478 Readings in Modern Hebrew (3 credits)
Prerequisite: HEBR313; or permission of instructor. Restriction: Junior standing or higher. Repeatable to 12 credits if content differs.
Variable topics in Modern Hebrew Literature.

JWST 491 Judaism and the Construction of Gender (3 credits)
Prerequisite: 1 course in JWST; or 1 course in LGBT; or 1 course in WMST. Also offered as: WMST491. Credit only granted for: JWST419X, JWST491, or WMST491. Formerly: JWST419X.
The study of Jewish culture, religious practice, communal authority, and literature through the frame of such critical categories of analysis as gender, sexuality, masculinity, power, ethics, and the feminine.

JWST 492 Sex, Gender, and Jewish Identity (3 credits)
Prerequisite: 1 course in WMST; or 1 course in JWST; or 1 course in LGBT; or permission of instructor. Credit only granted for: JWST492, JWST409G, JWST419W, LGBT448W, or WMST498W. Formerly: JWST409G and JWST419W.
An exploration of Jewish embodiment, including dynamics related to biological sex, culturally-framed gender, and sexuality. Topics of discussion may include transgender and intersex Jews, stereotypes and gender performance, modesty, genetics, and body alteration. Focus is on contemporary Jewish culture, framed within the larger historical and textual tradition.

JWST 498 Advanced Language Module for Jewish Studies (1-3 credits)
Prerequisite: HEBR212 or JWST282; or permission of ARHU-Meyerhoff Program & Center for Jewish Studies.
A supplementary language module for students enrolled in designated Jewish Studies classes. Language of instruction English, texts in original language.

JWST 499 Independent Study in Jewish Studies (1-3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 6 credits if content differs.

JWST 600 General Seminar in Jewish Studies (3 credits)
Introduce graduate students to the fields, problems, and basic methods of research in the comtemporary practice of Jewish Studies. Consideration of chronological and historiographical problems, questions of the development of Jewish thought and literature and Jewish religious and cultural history in four rough chronological periods: Biblical Israel, Judaism in Antiquity, Judaism in the Middle Ages and Early Modern Period, and Modern Judaism.

JWST 609 Supervised Instruction-Practicum in Jewish Studies (1 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies.
Supervised instruction or supervised practicum in Jewish Studies. Intended for graduate students whose course work includes field work or classroom teaching.

JWST 619 Directed Readings in Jewish Studies (3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
Independent Study in Jewish Studies. Readings and papers.

JWST 648 Readings in Jewish History (3 credits)
Repeatable to 9 credits if content differs.
Focus on the central issues in Jewish history as well as the key historiographical debates on those issues.

JWST 658 Readings in Jewish Thought and Culture (3 credits)
Repeatable to 9 credits if content differs.
Examines key issues in the development of Jewish thought and culture.

JWST 678 Readings in Jewish Literature (3 credits)
Repeatable to 9 credits if content differs.
Examines selected themes or literatures in the development of Jewish literary traditions.

JWST 699 Independent Graduate Readings in Jewish Studies (1-3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 12 credits if content differs.
Independent readings or guided research in a field of Jewish Studies with a member of the Jewish Studies graduate faculty.

JWST 719 Readings in Jewish Studies (3 credits)
Repeatable to 99 credits if content differs.
Course exposes students to significant primary and secondary material on selected topics as well as the major methodological problems covered by professional scholars working on these topics.

JWST 799 Masters Thesis Research (1-6 credits)
Repeatable to 6 credits.
Research and Writing the Masters Thesis in Jewish Studies.

Kinesiology (KNES)

KNES 400 The Foundations of Public Health in Kinesiology (3 credits)
Prerequisite: Minimum grade of C- in KNES287; and must have completed or be concurrently enrolled in KNES360. Restriction: Senior standing or higher; and must be in a major within the SPHL-Kinesiology department. Credit only granted for: KNES400 or KNES498A. Formerly: KNES498A.
An investigation of the role of physical activity and inactivity in relation to health and well-being through a public health perspective. Past and current

perspectives on health promotion, health education, and social policies and approaches will be examined for various populations.

KNES 402 Biomechanics of Sport (3 credits)
Prerequisite: KNES300.
Mechanical determinants influencing sport techniques. A quantitative, scientific basis for sport analysis with emphasis on the application to numerous sport activities. Evaluation and quantification of the filmed performance of athletes.

KNES 440 Psychology of Athletic Performance (3 credits)
Prerequisite: KNES350. Restriction: Junior standing or higher. Credit only granted for: KNES498P, KNES689Z, or KNES440.
Examines the psychological factors, mechanisms, and processes in athletic performance. Utilizes a social psychological approach to focus on the study and review of individual performance in both the interpersonal and social context.

KNES 442 Psychology of Exercise and Health (3 credits)
Prerequisite: KNES350. Restriction: Junior standing or higher. Credit only granted for: KNES442 or KNES498O. Formerly: KNES498O.
Examines the antecedents and consequences of exerciese behavior. Explores motivation, attitude, control, socialization. Proposes intervention strategies at the individual, organizational and societal levels.

KNES 451 Children and Sport: A Psychosocial Perspective (3 credits)
Prerequisite: KNES350. Restriction: Junior standing or higher; and must be in a major within SPHL-Kinesiology department.
Examination of youth sports from a psychosocial perspective, including the impact of highly structured sports on young athletes and the complex social network of coaches, parents and peers.

KNES 455 Scientific Bases of Athletic Conditioning (3 credits)
Prerequisite: KNES360.
An examination of physical fitness/athletic conditioning programs stressing the practical application of exercise physiology theory for enhancing athletic performance. Cardiovascular considerations, strength and power development, nutrition, speed, muscular endurance, environmental considerations and ergogenic aids.

KNES 457 Managing Youth Programs: Educational, Fitness and Sport (3 credits)
Prerequisite: KNES370 and KNES287. Restriction: Junior standing or higher. Credit only granted for: KNES457 or KNES498Y.
An examination of the basic functions involved in managing physical education, fitness, and youth sports programs. Focus on leadership skills, organizational management, and techniques for applying learned skills in a variety of organizational settings that serve the nation's youth.

KNES 460 Physiology of Aging and the Impact of Physical Activity (3 credits)
Prerequisite: KNES360. Credit only granted for: KNES498F or KNES460. Formerly: KNES498F.
Biology of the aging process in healthy individuals and those with chronic disease, the effects of acute exercise and exercise training on the physiological decline that occurs in humans, and the role that regular physical activity plays on enhancing the quality of life and activities of daily living in individuals.

KNES 461 Exercise and Body Composition (3 credits)
Prerequisite: KNES360.
An in-depth overview on how body composition is measured, what it is composed of, and the physiological and biochemical signals that change it. The effects of acute and chronic exercise on food storage, breakdown, and use as an energy source, is the major focus. This information is applied to important issues in public health and athletic performance.

KNES 462 Neural Basis of Human Movement (3 credits)
Prerequisite: BSCI202, KNES385, and BSCI201; or permission of SPHL-Kinesiology department.
An introduction to the neural substrates which underlie postural and volitional movement. Neuroanatomical and neurophysiological basis of motor functioning; past and present conceptualizations of motor control and coordination; movement disorders; and maturation of the neuromuscular system.

KNES 463 Principles and Methods of Physical Activity Interventions (3 credits)
Prerequisite: KNES360 and KNES350. Credit only granted for: KNES463 or KNES498G.
Understanding of the planning, implementation, and evaluation of physical activity interventions. Intervention methods and practical strategies fo formulate well-conceived physical activity interventions across a variety of settings and participant populations.

KNES 464 Exercise Metabolism: Role in Health and Disease (3 credits)
Prerequisite: BSCI202, KNES360, and BSCI201. Credit only granted for: KNES464 or KNES498L.
Examines the role of metabolism in kinesiology, especially as it relates to physical inactivity, health and disease. Includes bioenergetics, substrate utilization, cell signaling, and metabolic gene expression and their impact on chronic health conditions or disease.

KNES 465 Physical Activity and Disease Prevention and Treatment (3 credits)
Prerequisite: KNES360. Credit only granted for: KNES465 or KNES498A.
Critically examines the scientific evidence that supports the use of physical activity to prevent and treat age-related diseases, including cardiovascular disease, diabetes, abnormal lipoprotein-lipid levels, hypertension, obesity, osteoporosis and cancer.

KNES 466 Graded Exercise Testing (3 credits)
Prerequisite: KNES360; or permission of SPHL-Kinesiology department.
Functional and diagnostic examination of the cardiovascular responses to graded exercise testing. Emphasis on electrophysiology, mechanisms of arrhythmias, normal electrical activation of the heart, axis termination and the normal 12-lead electrocardiogram.

KNES 467 Genetics in Physical Activity and Sport (3 credits)
Prerequisite: KNES360. Corequisite: STAT100; or students who have taken courses with comparable content may contact the department. Restriction: Junior standing or higher. Credit only granted for: KNES467 or KNES498Q.
Dedicated to understanding the role of genetics in kinesiology, especially within the contexts of physical activity and sport. Specific genes and phenotypes will be explored.

KNES 476 Honors Thesis Proposal (3 credits)
Corequisite: KNES478. Restriction: Must be a KNES Honors student; and senior standing. Credit only granted for: KNES476 or KNES498R.
Development of honors thesis proposal based on preliminary research and literature review. Presentation of formal proposal to the thesis committee and fellow honors students.

KNES 477 Honors Thesis (3 credits)
Prerequisite: KNES476. Corequisite: KNES478. Restriction: Must be a KNES Honors student; and senior standing. Credit only granted for: KNES399 or KNES477.
Advisement will be on the individual basis. Thesis must be defended in the honors seminar.

KNES 478 Honors Seminar (1-3 credits)
Restriction: Must be a KNES Honors student; and junior standing or higher. Repeatable to 4 credits if content differs. Credit only granted for: KNES398 or KNES478.
Guided discussion of research topics of current interest.

KNES 480 Measurement in Physical Education (3 credits)
Prerequisite: MATH110.
A study of the principles and techniques of educational measurement as applied to the teaching of physical education; study of the functions and techniques of measurement in the evaluation of student progress toward the objectives of physical education and in the evaluation of the effectiveness of teaching.

KNES 481 Biophysical Aspects of Human Movement (3 credits)
Prerequisite: KNES370, KNES300, KNES360, and KNES385.
Scientific principles and research techniques in the investigation of the biophysical basis of human movement.

KNES 482 Socio-behavioral Aspects of Human Movement (3 credits)
Prerequisite: KNES293, KNES350, and KNES287.
Derivation, formulation, and application of research in the socio-behavioral aspects of human movement.

KNES 483 Sport Marketing and Media (3 credits)
Prerequisite: KNES287. Restriction: Junior standing or higher; and must be in a major within SPHL-Kinesiology department.
Industry practices in sport marketing and media. Marketing strategies and consumer behavior in different sport contexts. Critical examination of selected social and economic issues related to the buying and selling of sport.

KNES 484 Sporting Hollywood (3 credits)
Prerequisite: KNES293 and KNES287. Restriction: Junior standing or higher. Credit only granted for: KNES484 and KNES498N.
Popular representations of sport within the film media related to wider social discourses on bodies and the politics of various categories of subjectivity (gender, sexual, racial, class and national).

KNES 485 Sport and Globalization (3 credits)
Prerequisite: KNES287. Restriction: Junior standing or higher. Credit only granted for: KNES485 and KNES498T.
Examination of sport culture from a global perspective; focuses on theorizing the similarities and differences between various national sporting cultures.

KNES 487 Women, Sports and Culture (3 credits)
Prerequisite: KNES287. Restriction: Junior standing or higher. Credit only granted for: KNES498E or KNES487.
A study of the historical barriers to women's participation in physical activity, efforts to dismantle those barriers, and the differentiation that exists in women's sport and physical culture today. Exploration of the historical and contemporary factors involving female athletes in U.S. culture.

KNES 491 The Curriculum in Physical Education (3 credits)
Prerequisite: KNES371, KNES300, and KNES360.
Curriculum sources, principles, and planning concepts, with emphasis on using valid criteria for the selection of content for physical education programs.

KNES 496 Quantitative Methods (3 credits)
Statistical techniques most frequently used in research pertaining to physical education. Effort is made to provide the student with the necessary skills and to acquaint the student with the interpretations and applications of these techniques.

KNES 497 Kinesiology Senior Seminar (3 credits)
Prerequisite: A professional writing course with a minimum grade of C-; and all 7 KNES core courses and 2 KNES option courses. And STAT100; or students who have taken courses with comparable content may contact the department. And minimum grade of C- in KNES400; or must be concurrently enrolled in KNES400. Restriction: Senior standing or higher; and must be in Kinesiology program.
Discussions of contemporary issues vital to the discipline, critiques of research in the student's area/areas of special interest, completion of a major project where the student will be asked to demonstrate the ability to carry out investigative processes in problem solving and critical writing under faculty direction.

KNES 498 Special Topics in Kinesiology (3 credits)
Prerequisite: Permission of SPHL-Kinesiology department. Repeatable to 99 credits if content differs.
Topics of special interest in areas not covered by regularly scheduled courses.

KNES 600 Kinesiology in Public Health (3 credits)
A broad introduction to public health within the context of the discipline of kinesiology, focusing on furthering the understanding of the ways kinesiology contributes toward achieving the goals of public health.

KNES 601 Epidemiology of Physical Activity (3 credits)
Prerequisite: KNES600; and must have completed an undergraduate statistics course (e.g., STAT100 or equivalent).
An exploration of basic epidemiological study design, methods, and health outcomes in the field of physical activity.

KNES 602 Physical Activity Program Planning and Evaluation (3 credits)
Recommended: KNES600.
An in-depth analysis of the planning, implementation, and evaluation of physical activity interventions and programs intended to achieve physical activity and public health goals.

KNES 603 Advanced Motor Development (3 credits)
The analysis of major theoretical positions in motor skill development. Stage theory in motor development; development of motor skill memory; the development of motor control and coordination; and the role of reflexes in motor development.

KNES 604 Development of Posture and Locomotion (3 credits)
Development of posture and locomotion in humans integrating the perspectives of biomechanics, neurophysiology, perception-action theory and dynamical systems.

KNES 609 Research Issues in Kinesiology (1-3 credits)
Prerequisite: Permission of SPHL-Kinesiology department. Repeatable to 6 credits.
Issues, methodologies, and critical analyses of current research in Kinesiology.

KNES 610 Methods and Techniques of Research (3 credits)
Studies methods and techniques of research used in Kinesiology; an analysis of examples of their use; and practice in their application to problems of interest to the student.

KNES 612 Qualitative Research (3 credits)
Theoretical frameworks and methodologies necessary to conduct qualitative research, including research designs, observation and interview methods, data analysis, and development of grounded theory.

KNES 613 Theories Physical Culture (3 credits)
Credit only granted for: KNES613 or KNES689I. Formerly: KNES689I.
Examines and assesses numerous social and cultural theories as frameworks for critically interpreting the varied institutions, ideologies, and embodiments of physical culture.

KNES 614 Cultural Studies and Physical Culture (3 credits)
Credit only granted for: KNES614 or KNES689P. Formerly: KNES689P.
Discusses the political commitments, constituents, and complexities of cultural studies, and their relevance for furthering the understanding of physical culture and the project of physical cultural studies.

KNES 615 The Body, Culture, and Physical Activity (3 credits)
Critically examines the social constitution and embodied experience of various empirical fields of physical culture, including sport, health, movement, exercise, recreation dance, and daily living related activities.

KNES 618 Current Readings in Exercise and Applied Physiology (1 credits)
Prerequisite: KNES360; or students who have taken courses with comparable content may contact the department. Credit only granted for: KNES618, KNES609P, or KNES609N.
Student-led presentations of contemporary literature in the areas of genetics, exercise science, fitness and health. Emphasis on papers describing new research findings, novel techniques, innovative methods, and emerging issues.

KNES 620 Teaching Kinesiology to Undergraduates (3 credits)
Credit only granted for: KNES620 or KNES689W. Formerly: KNES689W.
Analysis and application of innovative approaches to undergraduate kinesiology course design, teaching, and evaluation (e.g., problem-based learning, inquiry learning, simulations, collaboration, etc.).

KNES 630 Sociology of Sport in Contemporary Perspective (3 credits)
Studies social organization and the role of individuals and groups in sport situations: the interrelationship of sport with traditional social institutions; sport as a sub-system and its structure; and sport and social problems.

KNES 631 Sport Event Management and Marketing (3 credits)
This course is designed to introduce students to principles and practices of planning, funding, operating, managing, and evaluating events in the sports industry.

KNES 635 Foundations of Sport Management (3 credits)
Fundamental skills and principles in the management of sport organizations, including concerns involved in managing sport in public, private, for profit and not for-profit sectors.

KNES 636 Sport and Mass Media (3 credits)
Examination of various mass media theories applied to sport. Application of communication theory to the study of mediated sport. Research methodologies and critical thinking.

KNES 650 Mental and Emotional Aspects of Sports and Recreation (3 credits)
Prerequisite: KNES350.
An exploration of psychological aspects of physical education, sports and recreation. Includes personality dynamics in relation to exercise and sports. A study is made of the psychological factors in athletic performance and coaching.

KNES 660 Psychology of Athletic Performances (3 credits)
Prerequisite: KNES350. Credit only granted for: KNES660 or KNES689Z. Formerly: KNES689Z.
Psychological factors, mechanisms, and processes in athletic performance. The basic approach is social psychological, according to which the focus is on individual performance in the interpersonal athletic context. Intrapersonal and interpersonal factors and their effects on athletic performance. Psychology of peak performance, choking, and errors of mental control. Analysis of the general principles and types of mental training.

KNES 663 History of Sport in Western Culture (3 credits)
The history of sport in the ancient, medieval and renaissance West.

KNES 670 Biomechanics Theory (3 credits)
Prerequisite: MATH221 or MATH141.
Theoretical basis for understanding the investigation of biomechanical aspects of the human body. Integration of subject matter from physics, engineering, anatomy, kinesiology, and physiology as it relates to the study of human motion and the body as a mechanical system.

KNES 676 Multisensory Perception and Human Motor Control (3 credits)
Overview of the major sensory inputs to human motor control and spatial orientatin including auditory, somatosensory, visual and vestibular.

KNES 688 Seminar in Motor Learning and Performance (3 credits)
Prerequisite: KNES385 and KNES496. Repeatable to 6 credits.
Discussion of research dealing with advanced topics in motor learning and skilled performance. Recent developments concerning individual differences, refractoriness, anticipation and timing, transfer, retention, and work inhibition are emphasized.

KNES 689 Special Problems in Kinesiology (1-6 credits)
Master or doctoral candidates who desire to pursue special research problems under the direction of their advisor may register for 1-6 hours of credit under this number.

KNES 691 Muscular Aspects of Exercise Physiology (3 credits)
Prerequisite: KNES360.
Recommended: BSCI422.
Skeletal muscle structure and function including muscle development, excitation-contraction coupling, muscle fiber types and fatigue, muscle biochemistry, gene expression, muscle damage and regeneration. The effects of aging and exercise training on skeletal muscle.

KNES 692 Cardiovascular Aspects of Exercise Physiology (3 credits)
Prerequisite: KNES360.
A comprehensive consideration of the various cardiovascular factors affecting human physical performance. Emphasis on the regulation of cardiovascular functions during physical activity. Energy liberation and transfer, circulation, respiration, temperature regulation, physiology of work at altitudes, aerobic endurance training, and exercise, health and aging.

KNES 694 Metabolic Aspects of Exercise Physiology (3 credits)
Prerequisite: KNES360.
Recommended: BCHM462 and BCHM461.
Effects of exercise on digestion, absorption, transport, storage, mobilization, and utilization of macronutrients. Emphasis on the effects of exercise training on energy metabolism.

KNES 695 Laboratory Techniques in Exercise Physiology (3 credits)
Prerequisite: KNES360.
Lab exercise testing techniques and interpretation. Includes graded exercise testing, VO2 max, lactate threshold, phlebotomy, exercise economy, body composition, muscle biopsy, resting

metabolic rate, anaerobic power and blood flow.

KNES 696 Genetic Aspects of Health and Fitness (3 credits)
Prerequisite: KNES360; or students who have taken courses with comparable content may contact the department. Credit only granted for: KNES696 and KNES689Z. Formerly: KNES689Z.
An exploration of the impact of genetic variation on human health and fitness, with emphasis on the physiological response to exercise. Consideration of human genome biology, DNA sequence databases, methods, gene/environment interaction, and ethical issues.

KNES 703 Research Seminar in Motor Development (3 credits)
Prerequisite: KNES603; or permission of SPHL-Kinesiology department.
Issues and strategies in the design and evaluation of research in motor skill development. Course culminates in student planning, conducting and interpreting a reserch study.

KNES 711 Professional Development and Grantsmanship (3 credits)
Restriction: Must be a Doctoral student; and must be in a major in SPHL-School of Public Health. Credit only granted for: KNES711 or KNES789X. Formerly: KNES789X.
Enhance continued professional development through an exploration of culture, climate, expectations and mentoring in research I universities. Generate a grant application including the hypothesis, structure, specific aims, background and significance, and submission of a total grant. Grant process and product will be emphasized.

KNES 735 Sport Marketing (3 credits)
Prerequisite: KNES610 and KNES635. Restriction: Permission of instructor.
Consumer behavior, marketing research, marketing strategy, integrated marketing communication and event marketing as applied to sport.

KNES 785 Internship in Physical Activity and Public Health (3 credits)
Prerequisite: KNES600, EPIB610, EPIB650, HLSA601, HLTH665, MIEH600, and KNES601. Recommended: KNES602.
The internship is a time-limited, supervised period of public/community health activities carried out in a health or allied health organization involved with physical activity. Students gain practical experience in areas such as program planning and implementation, program evaluation, public policy analysis, research, and management.

KNES 786 Capstone Project in Physical Activity and Public Health (3 credits)
Prerequisite: KNES600, EPIB610, EPIB650, HLSA601, HLTH665, MIEH600, and KNES601. Recommended: KNES602.
The culminating experience in which the student applies knowledge and skills learned in the MPH program to conduct independent work on a physical activity problem under the supervision of a faculty advisor.

KNES 789 Advanced Projects in Kinesiology (1-3 credits)
Repeatable to 3 credits.
Advanced projects examining current problems and trends in kinesiology.

KNES 798 Internship in Physical Education/Sports Management (1-8 credits)
Prerequisite: Permission of SPHL-Kinesiology department. Repeatable to 8 credits.
Practical application of previously acquired skills and knowledge in a sport and/or physical education setting. Emphasis on selected experiences to enhance the total academic program of the student. The internship site assignment will depend upon student's background and career goals.

KNES 799 Master's Thesis Research (1-6 credits)

KNES 898 Pre-Candidacy Research (1-8 credits)

KNES 899 Doctoral Dissertation Research (1-8 credits)

Korean (KORA)

KORA 499 Independent Study Korean (1-3 credits)
Prerequisite: Permission of instructor. Repeatable to 6 credits if content differs.
Independent study under faculty supervision.

Landscape Architecture (LARC)

LARC 420 Professional Practice (3 credits)
Prerequisite: LARC321. Restriction: Must be in Landscape Architecture program.
An introduction to and comparative study of the professional concerns of design firms. Focus on planning, legal, ethical, marketing and management considerations of interdisciplinary practices.

LARC 440 Urban Studio Design (5 credits)
Prerequisite: LARC321; and LARC340; and LARC341. Restriction: Must be in Landscape Architecture program.
The landscape architect's role within the interdisciplinary urban design process, focusing on urban site design issues. Pedestrian friendly site design and the future of sustainable development will be studied.

LARC 450 Environmental Resources (3 credits)
Prerequisite: ENST200; or permission of AGNR-Plant Science & Landscape Architecture department.
A review of ecosystems and an examination of planning strategies for preservation, conservation, management and development of sensitive natural and cultural landscape resources in the mid-Atlantic region.

LARC 451 Sustainable Communities (3 credits)
Explores concepts, strategies and examples of community design which address the needs of a growing population while preserving the environment and its resources.

LARC 452 Green Infrastructure and Community Greening (3 credits)
Prerequisite: PLSC100 or PLSC101; or permission of instructor. Restriction: Junior standing or higher. Credit only granted for: LARC489G or LARC452. Formerly: LARC489G.
A critical look and exploration of green infrastructure (GI) elements in the built environment in contributing to ecosystems services and the sustainability of the built environment. The course explores the science, issues, challenges, and the policy, planning and design solutions offered by green infrastructure.

LARC 460 Landscape and Identity: Placemaking Across World Cultures (3 credits)
Prerequisite: LARC240; or permission of AGNR-Plant Science & Landscape Architecture department. Restriction: Junior standing or higher.
A cross cultural experience that emphasizes the integration of cultural diversity, individual identity and placemaking skills introduced through the landscape architecture curriculum. Explores the landscape as intimately connected to their individual selves and to the collective sense of community. Examines how the mixture of social-cultural systems, on a global scale, impacts the way we shape our built environment. Investigates these

phenomena theoretically and analytically through team and individual projects, lectures, films, discussions and presentations.

LARC 461 People and the Environment (3 credits)

Repeatable to 3 credits if content differs. Credit only granted for: LARC489K or LARC461. Formerly: LARC489K.

Focus is placed on human and environmental interactions. Students will look at both natural and built environments and how they influence human health and well-being. Many environmental settings will be examined. These include hospitals, public housing neighborhoods, school settings, retirement communities, transportation corridors and green spaces. We will also explore how racial and socio-economic factors affect living and working environmental conditions. Ultimately, students will be using this knowledge to create environments that support individuals, families and various community groups' health and well-being.

LARC 470 Landscape Architecture Seminar (3 credits)

Prerequisite: LARC321; and LARC341. Corequisite: LARC440. Restriction: Senior standing; and must be in Landscape Architecture program.

A combination of self-directed study, seminar, and lecture formats. An introduction to aspects of research methods, critical analysis, and proposal writing with a focus on urban and community design.

LARC 471 Capstone Studio: Community Design (5 credits)

Prerequisite: LARC440; and LARC470. Restriction: Senior standing; and must be in Landscape Architecture program.

A capstone experience that emphasizes the integration of critical thinking skills and methodologies introduced throughout the landscape architecture curriculum. Students apply design and analysis methodologies, evaluate alternative solutions, involve community residents and engage in final design development, using the master plan and site design process, report writing, and oral and graphic presentations. Final presentations are open to the university and the community.

LARC 489 Special Topics in Landscape Architecture (1-4 credits)

Prerequisite: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 4 credits if content differs.

Credit according to time scheduled and organization of course. A lecture and/or studio course organized as an in-depth study of a selected specialization of landscape architecture not covered by existing courses.

LARC 499 Independent Studies in Landscape Architecture (1-4 credits)

Prerequisite: 12 credits in LARC courses; or permission of AGNR-Plant Science & Landscape Architecture department. Restriction: Must be in Landscape Architecture program; or must be in Plant Sciences program. Repeatable to 4 credits if content differs.

Independent studies in landscape architecture including field, studio or library research under the direction of a faculty member.

LARC 620 Graphic Tools for Landscape Representation (3 credits)

Corequisite: LARC640. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.

This course integrates digital and analog methods of communication and provides an introduction to computer tools and techniques commonly used in landscape architecture practice. Non-drafting computer tools will be used to orient basic digital image capture, manipulation, and presentation formatting. Also includes techniques and application of various media for graphic communication associated with landscape architecture.

LARC 621 Digital Drafting and Mapping (3 credits)

Prerequisite: LARC620; or permission of AGNR-Plant Science & Landscape Architecture department.

The development and application of computing tools as used by the landscape architecture profession. Computer-Aided Design and Drafting (CADD) develops computer drafting skills using a variety of software programs. It also introduces students to Geographic Information Systems (GIS) mapping technologies, computational representations and modeling of landscape processes and solution methods for problems involving the special arrangement of land use activities.

LARC 640 Graduate Studio I (5 credits)

Corequisite: LARC620. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.

Principles and techniques of design as applied to shaping the landscape; developing concepts in visual thinking, environmental awareness, and design intervention through studio exercises and projects.

LARC 641 Graduate Studio II (5 credits)

Prerequisite: LARC640. Corequisite: LARC720. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.

Principles and techniques of site analysis, environmental design and site development for human settlements and interaction with natural systems. Will expand analytical skills through complex site design problems. Students will research, observe and apply low impact development and sustainable practices, become familiar with building and landscape types by investigating alternative arrangements on the land, and understand user needs and design for populations with a range of abilities. Will support LEED and sustainable practices and acknowledge the requirements of public health, safety, and welfare.

LARC 642 Graduate Studio III (5 credits)

Prerequisite: LARC641. Corequisite: LARC670. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.

A focus on the interaction of landscape science (hydrology, geology, etc.) with the necessities and mechanisms of human settlements (transportation, economics, etc.) emphasizing innovative and forward thinking solutions to urbanization and ecological problems. It will apply this knowledge to landscape analysis, recreational planning and design, and community development, emphasizing resource management, spatial organization, landscape character, and the physical and social structure of community services. This course will be required for both Trach 1 and Track 2 students.

LARC 648 Graduate Studio IV (5 credits)

Prerequisite: LARC721 and LARC642. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 6 credits if content differs.

An exploration that will focus on issues in landscape planning and design such as campus planning, urban housing and recreation, and neighborhood preservation, restoration and development. Projects will emphasize the value of responsible academic and civic landscapes, the place of historic resources in contemporary life, and innovative solutions for the integration of past and future landscapes.

LARC 660 Landscape and Identity: Placemaking Across World Cultures (3 credits)

Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.

Comparing and constrasting the Eurocentric view of landscape with various other cultural perspectives that offer alternative narratives of landscape and identity. The examination of cultural perspectives will parallel an ongoing exploration of how landscape can inform questions about the personal and social implications in an era globalization.

LARC 663 Landscape and Garden History (3 credits)
Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.
History of garden making and its evolution into design practice. Students will become familiar with narratives of garden art and landscape architecture through the study of selected key sites, designers, and visual written sources. A focus on gardens' past and afterlife; the nature of primary sources (both built and written), and how these can be evaluated and used. Primary sources will be drawn from several disciplines and include a wide array of genres: treatises, epistolary exchanges, tax returns, novels, poems, paintings and drawings.

LARC 670 Landscape Architecture Theory and Criticism (3 credits)
Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.
Review and analysis of the body of literature concerning landscape architecture and relationships between humans and both natural and designed environments. Topics may include: rationalism, ethics, aesthetics, social and economic values, postmodernism, feminist, multiculturalism, ecological determinism, preservation/conservation, and sustainability and ecological design. Each week students will lead a debate and discussion on a theoretical issue based on the assigned readings for that week.

LARC 671 Landscape Architecture Research Methods (3 credits)
Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.
Investigation and discussion of broad scope of research methods and the development of landscape design and planning research techniques and skills. The urban environment will be viewed primarily as a social and psychological environment, with concern for who uses these environments and the conflicts that can arise between user groups.

LARC 699 Independent Studies in Landscape and Architecture (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
Individual Instruction course.

LARC 720 Environmental Analysis and Site Engineering (3 credits)
Prerequisite: LARC640; or permission of AGNR-Plant Science & Landscape Architecture department. Corequisite: LARC641.
Techniques for prediction of alterations in social and natural processes brought about by human use of the land; application of such assessments to environmental management; basic methods of landscape alteration, augmentation, and control including grading, drainage, road and trail design, and stormwater management.

LARC 721 Landscape Construction Methods and Materials (3 credits)
Prerequisite: LARC720. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department.
Basic methods of constructing landscapes and manipulating the appropriate plant and inorganic materials for the creation of ecologically sustainable environments for human use. An examination of the use, properties, and detailing of materials used in landscape construction.

LARC 748 Advanced Special Topics Studio (5 credits)
Prerequisite: LARC648 and LARC671. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 10 credits if content differs.
Advanced special topics comprehensive landscape architecture studio-exploration will focus on cultural, behavioral and ecological issues in the physical planning and design of urban landscapes.

LARC 799 Master's Thesis Research (1-6 credits)
Prerequisite: LARC748. Restriction: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 12 credits if content differs.
Development of a terminal thesis on a problem in landscape architecture, designed to demonstrate comprehensive skills and knowledge achieved in the graduate program. The subject will be selected in consultation with an advisor and periodically reviewed with a committee headed by the advisor.

Latin American Studies (LASC)

LASC 403 Research and Information Sources in Latin American Studies (1 credits)
Corequisite: LASC458. Recommended: LASC234 and LASC235. Restriction: Senior standing. Also offered as: SPAN403.
A foundational course in Latin American Studies information sources. Students will devise a search strategy and explore reference materials available to the Latin American Studies researcher.

LASC 423 Research Sources and Methods in Latin America Studies (3 credits)
Research methodologies in Latin American studies.

LASC 448 Special Topics in Latin American Studies (3 credits)
Restriction: Junior standing or higher. Repeatable to 6 credits if content differs.
Intensive study of a selected topic related to Latin American Studies.

LASC 458 Senior Capstone Course in Latin American Studies (3 credits)
Prerequisite: LASC234 and LASC235; or permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Must be in Latin American Studies Certificate program; and senior standing.
Capstone course for advanced students in the Latin American Studies Certificate Program or other students with appropriate preparation. Interdisciplinary topics will vary each semester.

LASC 486 Internship in Latin American/Caribbean Studies (1-6 credits)
Prerequisite: Permission of Latin American Studies Center required; and student must have completed at least two LASC courses, one of which must be a required/core course (LASC/SPAN234, LASC/SPAN235, LASC/HIST250, or LASC/HIST251). Restriction: Minimum cumulative GPA of 2.5; and student internships must be approved by the Director, and students must secure an appropriate faculty mentor for the internship course. An internship course will be approved only if a faculty supervisor is available; and must have 60 credits or higher; and permission of Latin American Studies Certificate program. Additional information: The course is primarily intended for students seeking the Certificate in Latin American Studies, but exceptions will be considered for students with educational or career interests which lie in this area.
Internship experience with an organization that works with or studies Latin American and/or the Caribbean. This is an experiential learning course that provides semester-long training that enriches the student's academic field of study and the LASC Certificate. Students submit a final written report of their experience, including critical analysis of the institutional relevance to their major field of study and to Latin American Studies. Students will also be asked to give an oral presentation.

LASC 499 Independent Study in Latin American Studies (1-3

credits)
Restriction: Permission of instructor.
Independent Study in Latin American Studies.

Latin (LATN)

LATN 402 Tacitus (3 credits)
Readings are in Latin.

LATN 403 Roman Satire (3 credits)
Readings are in Latin.

LATN 405 Lucretius (3 credits)
Readings are in Latin.

LATN 410 Latin Historians (3 credits)
Latin historical writing as a literary genre. Influences, style, and literary techniques. Readings are in Latin.

LATN 415 Vergil's Aeneid (3 credits)
Formerly: LATN305.
Vergil's Aeneid: readings of selections in Latin and of the entire epic in English translation along with critical essays.

LATN 420 Cicero and Caesar (3 credits)
Reading and analysis of texts by M. Tullius Cicero and C. Iulius Caesar, with emphasis on the relationships between them and on the period of the Civil War. Readings are in Latin.

LATN 424 Silver Age Latin (3 credits)
Reading and analysis of selected texts. Emphasis on the role of Nero and Seneca in literary developments. Readings are in Latin.

LATN 472 Historical Development of the Latin Language (3 credits)
Credit only granted for: LATN472 or LING431.
An analysis of the development of the Latin language from archaic times to the Middle Ages.

LATN 488 Latin Readings (3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.
The reading of one or more selected Latin authors from antiquity through the Renaissance. Reports.

LATN 499 Independent Study in Latin Language and Literature (1-3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits if content differs.

LATN 604 Cicero (3 credits)
A study of Cicero's contributions to Roman literature and culture. Readings from the speeches, letters, and/or philosophical and rhetorical works. The development of Cicero's style, his philosophy, and his attitudes toward the changing political scene between 82 and 43 B.C.

LATN 605 Vergil (3 credits)
A study of Vergil's development as a literary artist and Augustan poet through readings in the Eclogues, Georgics, and Aeneid.

LATN 620 Archaic Latin (3 credits)
An investigation of both the evolving Latin language and the emerging literary genres of the late third and second centuries B.C.

LATN 622 The Age of Caesar (3 credits)
Life and works of G. Julius Caesar and of his contemporaries in their social, political and intellectual contexts. Close analysis of the texts and familiarization with major developments in modern scholarship.

LATN 623 The Augustan Age (3 credits)
Analysis of the major literary figures and genres in prose and poetry of the period from 43 BC to AD 14.

LATN 624 Silver Age Latin (3 credits)
An investigation of both the evolving Latin language and the major literary figures and genres in prose and poetry of the period from A.D. 14 through the mid-second century.

LATN 630 Latin Literature of the Late Empire (3 credits)
An examination of Latin literary texts from the third to the fifth centuries A.D., Christian as well as pagan.

LATN 631 Medieval Latin (3 credits)
An examination of literary documentary texts in Latin from the end of the Roman Empire to the Renaissance.

LATN 640 Latin Pedagogy (3 credits)
Learning styles and abilities in the Latin language classroom; textbooks and workbooks for teaching Latin; integrating Roman culture into language study; computer and technological resources for Latin Language instruction; using videos and feature films in Latin and classical civilization classes; the articulation between secondary school and college-level Latin study. Meets in a series of five day-long Saturday workshops and culminates in an outreach program for secondary school Latin students. Recommended for teachers, graduate students and undergraduates plannig to teach Latin.

LATN 672 Historical Development of the Latin Language (3 credits)
An analysis of the development of the Latin language from the archaic period to the Middle Ages.

LATN 688 Special Topics in Latin Literature (3 credits)
Repeatable to 9 credits if content differs.

LATN 699 Independent Studies in Latin Literature (1-3 credits)
Prerequisite: Permission of ARHU-Classics department. Repeatable to 6 credits.

LATN 799 Master's Thesis Research (1-6 credits)

Library Science (LBSC)

LBSC 499 Workshops, Clinics, and Institutes (1-9 credits)
Repeatable to 9 credits.
Workshops, clinics, and institutes developed around specific topics or problems. Primarily for practicing librarians.

LBSC 602 Serving Information Needs (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC602, or both LBSC601 and LBSC650.
An introduction to the skills necessary to interact directly with individuals through the exploration of user behavior theory, strategies to locate and evaluate information from print and electronic resources, and policies and procedures to ensure that all individuals can become information literate.

LBSC 605 Archival Principles, Practices, and Programs (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Restriction: Admission to the Archives, Records, and Information Management Specialization; or permission of instructor.

Introduction to all aspects of archival work, including records management, selection, appraisal, arrangement, description, preservation, reference, outreach, and special media including electronic records. Overview of the elements of an archival program, the role and work of archivists, contemporary issues and conditions, and professional needs.

LBSC 611 History of the Book (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC611 or LBSC078B. Formerly: LBSC708B.
Introduction to the history and development of the book from pre-printing and incunabula to the post-modern book. Book illustration; publishing; collecting.

LBSC 620 Diverse Populations, Inclusion, and Information (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Importance of equality of information access. Social, political, and technological barriers to information. Information needs of diverse and underrepresented populations. Principles of inclusive information services.

LBSC 622 Information and Universal Usability (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Information services and technologies to provide equal experiences and outcomes to all users. Laws, standards, approaches, component concepts, access needs, and technologies in relation to physical and online information environments.

LBSC 631 Achieving Organizational Excellence (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC631 or LBSC635.
Overview of the principles, practices, and techniques required for effective leadership and management. The innovative strategies, management responsibilities, and skills needed to achieve and sustain high organizational performance in information-based cultural institutions.

LBSC 640 School Librarians as Information Professionals (3 credits)
Restriction: Permission of INFO-College of Information Studies; and permission of instructor. Credit only granted for: LBSC640 or LBSC643. Formerly: LBSC643.
Foundational concepts in information studies and in school library programs and services. Current and evolving educational systems; roles and functions of school librarians within them.

LBSC 641 Selecting and Evaluating of Resources for Learning (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Policies and procedures for collection development, including identifying, evaluating, acquiring, providing, and promoting resources in all formats, to support learning and teaching in elementary and secondary schools.

LBSC 642 Integrating Technology into Learning and Teaching (3 credits)
Prerequisite: Permission of INFO-College of Information Studies. Credit only granted for: LBSC642 or LBSC708C. Formerly: LBSC708C.
Hardware, software, video and other equipment, and networking in schools. Pedagogic uses of information technology, including networked resources and multimedia.

LBSC 644 Collection Development (3 credits)
Prerequisite: LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC 644 or LBSC 708G. Formerly: LBSC 708G.
Activities through which library collections are systematically developed and managed are explored, especially the formulation and implementation of written collection development policies. Other specific topics include identification of user needs; collection evaluation; fund allocation among competing departments, subjects, and/or media; selection methods; intellectual freedom; storage alternatives; and cooperative collection development.

LBSC 645 Literature and Materials for Children (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Survey of literature and other materials for children and youth. Criteria for evaluating and using such materials as they relate to the needs, interests, reading abilities, and other capabilities of young readers.

LBSC 646 Literature and Materials for Young Adults (3 credits)
Prerequisite: Permission of INFO-College of Information Studies. Credit only granted for: LBSC646 or LBSC746. Formerly: LBSC746.
Survey of literature and other materials for older children and adolescents. Criteria for evaluating and using such materials as they relate to the needs, interests, reading abilities, and other capabilities of young readers.

LBSC 647 Children's Services in the Public Library (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Public library services for children from birth to 12 years of age. Developmental characteristics and information needs of children. Programming and collection development. Management of children's services, including planning, staffing, and advocacy.

LBSC 650 Information Access Services (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Information needs, search mediation, search strategies, reference services, information access issues, collection development.

LBSC 670 Organization of Information (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Functions and evaluation of document and information retrieval systems; analysis and representation of data, information, knowledge, language, and text; metadata for the control of documents and other objects.

LBSC 671 Creating Information Infrastructures (3 credits)
Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC671, or LBSC670 and LBSC690.
Foundations of acquiring and managing collections, information structures, indexing and discovery systems needed by information professionals. An introduction to the theoretical concepts, trends, systems, and technologies central to the information field.

LBSC 680 Principles of Records and Information Management (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Principles and practices of managing records in the context of information management programs in government, corporate and other institutional settings. Includes access; legal requirements; digital technologies; and creation, administration, appraisal, and retention and disposition of records.

LBSC 682 Management of Electronic Records & Information (3 credits)
Restriction: Permission of INFO-College of Information Studies.
Role of archivists and records managers in the management of electronic records. Focuses on the life cycle of records and

the impact of technology programs for managing electronic records.

LBSC 684 Archival Arrangement and Description (3 credits)
Prerequisite: LBSC605; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Principles of archival arrangement and description and their application to making archival material available for research and other uses. National and international standards for archival description. Studies of users of archival descriptive systems. Current and emerging issues.

LBSC 690 Information Technology (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Human-centered design issues, implementation and technical issues, and application and sociotechnical issues of information technology; emerging information technologies.

LBSC 698 Children's Information Technology and Policy (3 credits)
Restriction: Permission of INFO-College of Information Studies. Repeatable to 6 credits if content differs. Credit only granted for: LBSC698 or LBSC708N. Formerly: LBSC708N.
Topics and issues in information technology and children.

LBSC 702 User Instruction (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Critical analysis of the rationale, content, and processes of user instruction in library and information settings.

LBSC 703 Field Study in Archives, Records and Information Management (3 credits)
Prerequisite: LBSC605, LBSC650, LBSC670, and LBSC690; and must have completed 12 additional credits. Restriction: Permission of INFO-College of Information Studies.
Supervised experience in archival, records, or information management programs in organization and institutions. Application of theories, methods, and approaches to effectively carry out work and meet program goals.

LBSC 706 Seminar in International and Comparative Librarianship and Information Science (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Comparison and contrast of bibliographic systems, institutions, service arrangements, and professional patterns in developed and developing cultures. Libraries, information organizations, and international information systems viewed against the backdrop of national cultures. Influences of social, political, and economic factors upon these forms.

LBSC 707 Field Study in Library Service (3 credits)
Prerequisite: LBSC601, LBSC650, LBSC670, and LBSC690; and must have completed 12 additional credits. Restriction: Permission of INFO-College of Information Studies.
Supervised experience within library operations and/or the opportunity to perform a study to solve a specific problem in a suitable library or other information agency.

LBSC 708 Special Topics in Information Studies (1-3 credits)
Prerequisite: Permission of INFO-College of Information Studies. Repeatable to 9 credits if content differs. Additional information: No student may earn more than a total of 12 credits in both LBSC 708 and LBSC 709.
Consult Schedule of Classes or CLIS informational materials for specific offerings.

LBSC 709 Independent Study (1-3 credits)
Prerequisite: Permission of instructor; and permission of advisor. Restriction: Permission of INFO-College of Information Studies.
Intensive individual study, reading, or research in an area of specialized interest under faculty supervision.

LBSC 713 Planning and Evaluating Library Services (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
analysis of quantitative and qualitative methods for planning and evaluating library and information services. Demonstration and use of selecte d methods, including project planning and monitoring methods.

LBSC 723 Advocacy and Support for Information Services (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Role and influence of government, foundations, associations, and other organizations in supporting and setting the agenda for information services of all types. Role of information professionals in demonstrating advocacy, fund-raising, public relations, lobbying, and seeking external support.

LBSC 724 Public Library Seminar (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Organization, support, and service patterns of public libraries. The public library in national, state, and local contexts.

LBSC 731 Special Collections (3 credits)
Prerequisite: LBSC605 or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Management of special collections, whose holdings may include manuscripts (particularly personal papers), non-textual materials, graphical materials, and rare books, with analysis of the custodial and management functions associated with special collections.

LBSC 734 Seminar in the Academic Library (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Role of the academic library within the framework of higher education. Planning programs and services, collections, support, fiscal management, physical plant, and cooperation.

LBSC 735 Legal Issues in Managing Information (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Legal issues related to collecting, maintaining, and providing access to information materials. Includes ownership, copyright, privacy, freedom of information, and related issues in archives, libraries and other settings.

LBSC 737 Seminar in the Special Library and Information Center (3 credits)
Prerequisite: LBSC601, LBSC690, LBSC670, and LBSC650; or (LBSC602, LBSC631, and LBSC671); or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Role of special libraries and information centers in the information transfer process. Analysis of the information transfer system; information needs and uses; management of special libraries and information centers; and types of libraries, such as governmental or industrial libraries, archives, and information analysis centers.

LBSC 741 Seminar in School Library Administration (3 credits)
Prerequisite: LBSC640; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Development, management, and

evaluation of school library programs at all levels.

LBSC 742 Collaborative Instructional Design and Evaluation (3 credits)
Prerequisite: LBSC640; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
School librarians' collaborative role in instruction. Systematic design, development, and evaluation of instructional strategies and products for learning.

LBSC 744 Internship in School Libraries (3 credits)
Prerequisite: LBSC640, LBSC742, and LBSC741; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Opportunities to observe and participate in the operation of school libraries at the elementary and secondary levels under the supervision of certified school librarians.

LBSC 745 Storytelling Materials and Techniques (3 credits)
Prerequisite: LBSC645; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Literary sources and instruction and practice in oral techniques.

LBSC 748 Advanced Seminar in Children's Literature (3 credits)
Prerequisite: Permission of INFO-College of Information Studies. And LBSC645; or permission of instructor.
Selected topics in literature for children and adolescents, including historical aspects, individual authors, and major themes and trends.

LBSC 750 Information Access in Electronic Environments (3 credits)
Prerequisite: LBSC650 or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Analysis of information problems, search strategy development, evaluation of electronic resources, command language comparisons, evaluation of search results.

LBSC 751 Information Access in the Humanities (3 credits)
Prerequisite: LBSC650 or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Research methods, information needs, information structure, and information sources and services in the humanities (for example, religion, philosophy, language, literature, history, music history, art history).

LBSC 752 Information Access in the Arts (3 credits)
Prerequisite: LBSC650 or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Research methods, practice, information needs, information structure, and information sources and services in the visual arts (for example, fine arts, decorative arts, architecture, photography) and the performing arts (for example, theater, film, music, dance, and costume).

LBSC 753 Information Access in the Social Sciences (3 credits)
Prerequisite: LBSC650 or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Research methods, information needs, information structure, and information sources and services in the social sciences (for example, anthropology, economics, education, geography, history, political science, psychology, sociology).

LBSC 756 Information Access in Science and Technology (3 credits)
Prerequisite: LBSC650; or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Research methods, information needs, information structure, and information sources and services in science and technology (for example, biology, chemistry, physics, math, agriculture, computer science, engineering).

LBSC 766 Access to Business Information (3 credits)
Prerequisite: LBSC650; or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Research methods, information needs, information structure, information sources and services related to business.

LBSC 767 Access to Federal Government Information (3 credits)
Prerequisite: LBSC650; or LBSC602; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Research methods, information needs, information production and structure, information sources and services, and selection policies related to federal government information.

LBSC 770 Metadata and Tools for Information Professionals (3 credits)
Prerequisite: LBSC671; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Principles, standards, and practices of information representation to facilitate accessing needed information in digital bibliographic environments. Includes exposure to Metadata, XML, RDA/AACR2R, DTDs, MARC, Dublin Core, MODS, ISBN and ISSN, FRBR, FRAD, Classification systems, and Controlled Vocabularies such as LCSH, SEARS, NLM, Getty and ERIC Thesauri, and others.

LBSC 773 Classification Theory (3 credits)
Prerequisite: LBSC670; or LBSC671; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Survey of classificatory principles from bibliographic, philosophical, biological, psychological, and linguistic perspectives. Challenges to traditional principles from the cognitive sciences and their implementations for bibliographic classification.

LBSC 774 Seminar in Linguistic Topics (3 credits)
Prerequisite: LBSC670; or LBSC671; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Topics in linguistics with applications in information science. Syntax and semantics as they apply to the analysis of communication processes and to natural language processing for information storage and retrieval.

LBSC 775 Indexing, Abstracting and Thesaurus Construction (3 credits)
Prerequisite: LBSC671; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Fundamentals of indexing, abstracting, and thesaurus construction in theory and practice, including: the formation of vocabularies; construction of a thesaurus; systems of indexing; effects of systems upon information retrieval; style and format of abstracts; evaluation of abstracting services; and requirements of users of abstracts. The design and construction of index languages/thesauri and analysis and evaluation of existing index languages/thesauri. Discussion of currently available indexing software packages.

LBSC 781 Access Techniques and Systems for Archives (3 credits)
Prerequisite: Permission of INFO-College of Information Studies; and LBSC605.
Methods, approaches, and systems to locate, access, and use archival records, including systems analysis, control systems. researcher services, descriptive formats and techniques, and the use of digital technologies and the Internet for accessing archival records.

LBSC 783 Seminar in Technical Services (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Technical services in large libraries, including acquisitions, cataloging, serials control, automation, cooperative programs, and managerial controls.

LBSC 784 Digital Preservation (3 credits)
Prerequisite: LBSC605 or INST604; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Credit only granted for: LBSC708Q or LBSC784. Formerly: LBSC708Q.
Issues and practices regarding digitization of analog materials and preservation of digital materials, both digitized and born digital.

LBSC 785 Documentation, Collection, and Appraisal of Records (3 credits)
Prerequisite: LBSC605 or INST604; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Development of documentation strategies and plans; collecting policies to guide programs in acquiring records; theories and techniques for appraising records to identify those with continuing value.

LBSC 786 Library and Archives Preservation (3 credits)
Prerequisite: Permission of INFO-College of Information Studies.
Literature and key issues in the preservation of archival and library materials. The development of preservation programs and the establishment and maintenance of effective management techniques. The nature of the materials from which archives and books are made, causes of damage and deterioration, binding structures and environmental concerns will be discussed within the context of general archives and libraries administration.

LBSC 788 Seminar in Archives, Records, and Information Management (3 credits)
Prerequisite: LBSC605; or INST604; or permission of instructor. Restriction: Permission of INFO-College of Information Studies. Repeatable to 6 credits if content differs.
Analysis and discussion of issues and topics in the development and administration of programs for archives, records and information management. Repeatable with permission of instructor.

LBSC 789 Special Topics in Contemporary Archives (3 credits)
Prerequisite: LBSC605; or INST604; or permission of instructor. Restriction: Permission of INFO-College of Information Studies.
Issues in administering contemporary archives and records management programs.

LBSC 790 Building the Human-Computer Interface (3 credits)
Prerequisite: Must have experience in programming; and permission of INFO-College of Information Studies. Corequisite: Concurrently enrolled in LBSC795; or concurrently enrolled in CMSC434. Credit only granted for: LBSC708L or LBSC790. Formerly: LBSC708L.
Principles and techniques for user interface implementation. Principles for building reliable large-scale interface components. Use of prototyping and rapid development tools. Techniques for managing user input and visual and auditory displays.

LBSC 791 Designing Principled Inquiry (3 credits)
Prerequisite: LBSC671, LBSC602, and LBSC631; and additional 15 credits in LBSC course work. Restriction: Permission of INFO-College of Information Studies.
Critical analysis of roles of information professions and institutions in integrating theory, methods, practice, policies, and values of the field, and applying them to the design of future information systems and services.

LBSC 799 Master's Thesis Research (1-6 credits)
Prerequisite: INST701; and permission of instructor. Restriction: Permission of INFO-College of Information Studies.

Lesbian Gay Bisexual Transgender Studies (LGBT)

LGBT 448 Special Topics in Lesbian, Gay, Bisexual, and Transgender Studies (3 credits)
Prerequisite: LGBT200; or permission of LGBT Studies Program. Restriction: Junior standing or higher. Repeatable to 9 credits if content differs.
In-depth study of particular themes and issues in LGBT studies.

LGBT 459 Selected Topics in Sexuality and Literature (3 credits)
Prerequisite: Must have completed two lower-level English courses, at least one in literature. Repeatable to 9 credits if content differs. Also offered as: ENGL459.
Detailed study of sexuality as an aspect of literary and cultural expression.

LGBT 465 Theories of Sexuality and Literature (3 credits)
Prerequisite: Must have completed two lower-level English courses, at least one in literature. Restriction: Must not have completed ENGL465. Also offered as: ENGL465. Credit only granted for: ENGL465 or LGBT465.
An in-depth study of the ways in which sexuality and sexual difference create or confound the conditions of meaning in the production of literary texts. Attention to psychoanalysis, history of sexuality, feminist theory, and other accounts of sexual identity.

LGBT 488 Seminar in Lesbian, Gay, Bisexual, and Transgender Studies (1-3 credits)
Prerequisite: 9 credits in LGBT courses; and permission of LGBT Studies Program. Recommended: LGBT200. And ENGL265; or CMLT291. Repeatable to 9 credits if content differs. Formerly: CMLT498Y.
Developments in theories and methods of LGBT Studies, with emphasis upon interaction between the humanities and the social sciences in the elaboration of this interdisciplinary area of scholarship.

LGBT 494 Lesbian Communities and Differences (3 credits)
Prerequisite: Must have completed one course in Women's Studies, preferably WMST200 or WMST250. Also offered as: WMST494. Credit only granted for: LGBT494 or WMST494.
The meanings of lesbian communities across many lines of difference. Using lesbian-feminists of the 1970s as a starting point, we will look both back and forward in history, tracing changes and exploring the meanings of these in their social and historical contexts.

LGBT 499 Independent Study (1-3 credits)
Prerequisite: LGBT200; and permission of LGBT Studies Program. Restriction: Senior standing. Repeatable to 6 credits if content differs.
Directed research and analysis in LGBT Studies on a topic selected by the student.

Linguistics (LING)

LING 410 Grammar and Meaning (3 credits)
Prerequisite: Permission of instructor; or LING311.
The basic notions of semantic theory: reference, quantification, scope relations, compositionality, thematic relations, tense and time, etc. The role these notions play in grammars of natural languages.

Properties of logical form and relationship with syntax.

LING 411 Comparative Syntax (3 credits)

Prerequisite: LING312; or permission of instructor.

Comparison of data from a variety of languages with respect to syntactic theory in order to investigate how parameters of universal grammar are fixed differently in different languages. Attempts to work out fragments of grammars for some languages.

LING 419 Topics in Syntax (3 credits)

Prerequisite: LING311. Repeatable to 12 credits if content differs.

Topics vary.

LING 420 Word Formation (3 credits)

Prerequisite: LING321 and LING311.

Examination of shape and meaning of possible words, both across languages and within particular languages. Interaction between principles of word formation and other components of a grammar: syntax, logical form and phonology.

LING 429 Topics in Phonology (3 credits)

Prerequisite: LING322. Repeatable to 6 credits if content differs.

Advanced seminar in phonology. Topics vary.

LING 430 Language Change (3 credits)

Prerequisite: LING240.

Changes in grammars from generation to generation. Consequences for the theory of grammars. Traditional work on historical change.

LING 439 Topics in Diachronic Linguistics (3 credits)

Repeatable to 6 credits if content differs.

LING 440 Grammars and Cognition (3 credits)

Prerequisite: LING321 and LING311.

Relationship between the structure, development and functioning of grammars and the structure, development and functioning of other mental systems. Interpretations of experimental and observational work on children's language, aphasia, speech production and comprehension.

LING 443 Programming for Linguistics (3 credits)

Prerequisite: Permission of ARHU-Linguistics department.

A one-semester introduction to computer programming, geared for linguists and others who are not computer scientists. Not intended for students who already have significant programming experience.

LING 444 Child Language Acquisition (3 credits)

Prerequisite: LING311.

Examines language acquisition in infancy and early childhood: the nature of children's linguistic representations and how these develop naturally. Role of (possible) innate linguistic structure and interaction of such structure with experience. Evaluation of methods and results of current and classic research leading to contemporary models of language development.

LING 448 Advanced Laboratory Research in Linguistics (2-3 credits)

Prerequisite: LING248; and (LING200 or LING240). Restriction: Permission of instructor. Repeatable to 6 credits if content differs. Additional information: This course is part of a two-semester sequence. Ling248 is a prerequisite. Ling248 and Ling448 must be completed in the same laboratory.

Individualized, collaborative research course aimed at developing skills for laboratory research in language acquisition, sentence processing or neurolinguistics. Conducting a research project in laboratory linguistics as part of a team creating original research relevant to current issues in linguistics.

LING 449 Topics in Psycholinguistics (3 credits)

Prerequisite: LING321 and LING311; or permission of ARHU-Linguistics department. Repeatable to 6 credits if content differs.

Critical evaluation of primary research in psycholinguistics. Relating theoretical hypotheses to experimental hypotheses and predictions. Evaluation of experimental results. Emphasis on hands-on experience and experimental methodologies. Specific topics vary.

LING 451 Grammars and Variation (3 credits)

Prerequisite: LING311.

Grammars and the use of language in a variety of styles: formal, casual, literary, etc. Consequences for concepts of grammars. Variation theory. Literary styles.

LING 453 Mathematical Approaches to Language (3 credits)

Prerequisite: LING312.

The aspects of mathematics used in linguistic discussions: recursion theory, Chomsky's hierarchy of grammars, set theory, Boolean algebra, finite state grammars, context-free grammars, etc. Applications to theories of grammars. Formalizations of grammatical theories.

LING 455 Second Language Acquisition (3 credits)

Prerequisite: LING311.

Examines second language acquisition from the perspective of Chomsky's 'Universal Grammar'. Relationship between theories of grammars, first language acquisition by children and the learning of second languages by adults.

LING 460 Diversity and Unity in Human Languages (3 credits)

Prerequisite: LING240 or LING200.

Fundamentals of grammatical typology as they relate to issues in social attitudes towards language. Linguistic structure of standard and non-standard languages and dialects. Relationship of different writing systems to linguistic structure. Issues in bilingualism and multilingualism.

LING 487 Computer Science for Cognitive Studies (3 credits)

Credit only granted for: LING487 or PHIL487.

List processing and discrete mathematics. Preparation for the study of artificial intelligence and other mathematically oriented branches of cognitive studies. Intended for students of linguistics, philosophy, and psychology. LISP computer language, graphs and trees, the concept of computational complexity, search algorithms.

LING 499 Directed Studies in Linguistics (1-3 credits)

Prerequisite: Permission of ARHU-Linguistics department. Repeatable to 6 credits if content differs.

Independent study or research on language under the supervision of a faculty member.

LING 610 Syntactic Theory (3 credits)

Prerequisite: LING312.

Intensive introduction to transformational syntax.

LING 611 Issues in Syntax (3 credits)

Prerequisite: LING610.

Topics of current theoretical interest examined through data from a variety of languages.

LING 617 Comparative Grammar and Psycho-Linguistics (3 credits)

Prerequisite: LING610. Recommended: LING640.

Techniques of grammatical analysis and shows how selecting the right grammatical phenomenon is critical for asking the right questions in processing/acquisition and how results using psycho-linguistic

techniques can be used to shed light on grammar evaluation.

LING 620 Phonological Theory (3 credits)

Prerequisite: LING322.
Topics in current phonological theory, as they relate to data from various languages. Segmental and prosodic analysis. Autosegmental theory, metrical theory, etc.

LING 621 Issues in Phonology (3 credits)

Prerequisite: LING620.
Topics of current interest in phonological theory examined through data from several languages.

LING 625 Morphology and the Lexicon (3 credits)

The structure of words and investigation of how word formation processes interact with other components of grammar.

LING 640 Psycholinguistics (3 credits)

Restriction: Permission of instructor.
Core graduate course in psycholinguistics, covering leading theoretical approaches and experimental methods in language acquisition, language processing, and neurolinguistics.

LING 641 Issues in Psycholinguistics (3 credits)

Prerequisite: LING640.
Topics of current interest in psycholinguistics, including both theoretical approaches and experimental and analytical issues in language acquisition, language processing, and neurolinguistics.

LING 644 Language Acquisition (3 credits)

Prerequisite: LING640.
Interpretations of observational and experimental work on children's language development, and relationship between developmental stages and theories of human language faculties.

LING 646 Cognitive Neuroscience of Language (3 credits)

Restriction: Permission of instructor.
Overview of classical and recent work on the neural basis of speech and language, with a goal of introducing contemporary methods and results to prepare the student to read the neurolinguistics and cognitive neuroscience literature. An emphasis will be placed on current techniques.

LING 650 History of Linguistics (3 credits)

Prerequisite: LING312.
Different ways in which people have thought about language. Cartesian and neogrammarian theories. Development of the generative research program.

LING 658 History of a Language (3 credits)

Repeatable to 6 credits if content differs.
Detailed examination of the history of a single language or language family.

LING 659 Structure of a Language (3 credits)

Repeatable to 6 credits if content differs.
Detailed examination of a particular language or language family.

LING 660 Introduction to Semantics (3 credits)

Restriction: Permission of instructor.
Basic concepts and methods of contemporary semantic theory including basic set theory, elementary propositional and predicate calculus, the structure of predicates and propositions, quantification binding. Prepares students for study of more advanced topics in semantics.

LING 661 Issues in Semantics (3 credits)

Prerequisite: LING660; or permission of ARHU-Linguistics department.
A second course in semantic theory. Application of basic concepts and methods to topics of current theoretical interest.

LING 663 Pragmatics (3 credits)

Prerequisite: LING660 or PHIL660; or permission of instructor.
Recommended: LING661.
An intensive introduction to formal linguistic pragmatics: the study of systematic dependencies of meaning on context of use. Topics will include implicature, presupposition, reference, topic, focus, and the linguistic means of expressing these.

LING 689 Independent Study (1-3 credits)

Restriction: Permission of instructor; and must be in a major within ARHU-Linguistics department. Repeatable to 6 credits if content differs.
Independent studies in grammatical theory.

LING 698 Directed Study (1-3 credits)

Repeatable to 6 credits if content differs.

LING 723 Computational Linguistics I (3 credits)

Prerequisite: CMSC421; or students who have taken courses with comparable content may contact the department; or permission of instructor. Also offered as: CMSC723, INST735. Credit only granted for: CMSC723, LING723, or INST735. Formerly: LING645.
Fundamental methods in natural language processing. Topics include: finite-state methods, context-free and extended context-free models of syntax; parsing and semantic interpretation; n-gram and Hidden Markov models, part-of-speech tagging; natural language applications such as machine translation, automatic summarization, and question answering.

LING 773 Computational Linguistics II (3 credits)

Prerequisite: LING723 or CMSC723; or permission of instructor. Also offered as: CMSC773. Formerly: LING647.
Natural language processing with a focus on corpus-based statistical techniques. Topics include: stochastic language modeling, smoothing, noisy channel models, probabilistic grammars and parsing; lexical acquisition, similarity-based methods, word sense disambiguation, statistical methods in NLP applications; system evaluation.

LING 798 Research Papers in Linguistics (1-6 credits)

Prerequisite: LING611 and LING621. Repeatable to 6 credits if content differs.

LING 799 Master's Thesis Research (1-6 credits)

LING 819 Seminar in Syntactic Theory (3 credits)

Prerequisite: LING611. Repeatable to 6 credits if content differs.
Current topics in research on syntactic theory.

LING 829 Seminar in Phonological Theory (3 credits)

Prerequisite: LING621. Repeatable to 6 credits if content differs.
Current topics in research on phonology and morphology.

LING 839 Seminar in Language Change (3 credits)

Prerequisite: LING630. Repeatable to 6 credits if content differs.
Topics in research on historical change in language.

LING 848 Seminar in Computational Linguistics (3 credits)

Prerequisite: LING645; or permission of instructor.
Current topics in research in computational linguistics.

LING 849 Seminar in Psycholinguistics (3 credits)
Prerequisite: LING640 or LING641; or permission of instructor. Repeatable to 6 credits if content differs.
Current topics in research on psycholinguistics.

LING 859 Seminar in Language Acquisition (3 credits)
Prerequisite: LING640 or LING641; or permission of ARHU-Linguistics department. Repeatable to 6 credits if content differs. Credit only granted for: LING859 or LING889A. Formerly: LING889A.
Current topics in research on language acquisition.

LING 869 Seminar in Neurolinguistics (3 credits)
Prerequisite: LING640 or LING641; or permission of ARHU-Linguistics department. Repeatable to 6 credits if content differs. Credit only granted for: LING869 or LING889A. Formerly: LING889A.
Current topics in research on neurolinguistics.

LING 879 Seminar in Semantics (3 credits)
Prerequisite: LING660 or LING661. Repeatable to 9 credits if content differs. Formerly: LING889.
Current topics in research in semantics.

LING 889 Directed Research (1-8 credits)

LING 895 Doctoral Research Paper (6 credits)

LING 896 Research Paper in Minor Area (3 credits)
Prerequisite: LING895.
This course is designed to strengthen the students' ability to do research in a minor area of expertise, and to help them create a publishable piece. In addition, the course constitutes part of a set of requirements to advance to doctoral candidacy.

LING 898 Pre-Candidacy Research (1-8 credits)

LING 899 Doctoral Dissertation Research (1-8 credits)

Masters in the Mathematics of Advanced Industrial Tech (MAIT)

MAIT 613 Advanced Applied Linear Algebra (3 credits)
Prerequisite: Must have knowledge of basic linear algebra and computation; or permission of instructor.
Tools and techniques of computational linear algebra for applications. Topics include: linear systems and least squares problems, error analysis, accuracy and stability, matrix decompositions, iterative solvers, Krylov subspace methods, symmetric and non-symmetric eigenvalue problems, singular value decomposition.

MAIT 615 Quantum Information, Detection, and Computation (3 credits)
Introduction to information processing tasks implemented on fundamentally quantum mechanical systems. Topics include background physics, mathematics, and information theory, quantum cryptography, teleportation, super-dense coding, quantum computation, Shor's algorithm, quantum error correction, quantum limits in detection and estimation.

MAIT 623 Modern Mathematical Methods of Signal and Image Processing I (3 credits)
Prerequisite: Must have knowledge of advanced calculus and applications.
Introduction to current signal/image processing techniques, including wavelets and frames, in the context of applied and numerical harmonic analysis. Topics include time-frequency and time-scale representations, sub-band filterbanks, and applications to compression and denoising.

MAIT 624 Modern Mathematical Methods of Signal and Image Processing II (3 credits)
Prerequisite: MAIT623; or permission of instructor.
Advanced studies of state of the art signal/image processing using applied/numerical harmonic analysis. Topics include stable signal representation and erasure channel problems, 2nd-generation wavelets, geometric sub-division schemes for multi-dimensional problems, level set approaches, estimation and analysis of sensor data, and non-uniform sampling methods.

MAIT 626 Statistical Pattern Recognition and Classification (3 credits)
Mathematical and statistical tools for decision making based on categorization of patterns present in data. Topics include regression, feature extraction, dimensionality reduction, parametric and non- parametric approaches to decision, estimation, and classification problems.

MAIT 627 Fast Multipole Methods (3 credits)
Introduction to the fast multipole method, a matrix compression computational scheme analyzing wide classes of structured operators arising in physics, data analysis, and visualization. Topics include: single and multi-level FMM, iterative solvers, non-uniform interpolation schemes, Fast Gauss Transform, solutions of Laplace and Helmhotz equations.

MAIT 633 Applied Fourier Analysis (3 credits)
Prerequisite: Must have knowledge of advanced calculus; or permission of instructor.
Theory, practice, and implementation (e.g. MATLAB) of Fourier analysis with applications in signal processing. Topics include the Fourier transform for periodic and non-periodic functions in continuous and discrete time, generalized functions, sampling theorems, fast computational algorithms for transforms and convolutions, filterbanks and multirate systems.

MAIT 679 Special Topics in Mathematics of Advanced Industrial Technology (3 credits)
Special topics courses are intended to expose students to the latest developments in mathematical applications. As such, the content will vary depending on the instructor and the current state-of-the-art. 679 will appear with a letter appended to distinguish different topics. New 679 courses will be added as areas of interest arise.

MAIT 699 Independent Masters Project (1-3 credits)
Restriction: Permission of instructor. Repeatable to 12 credits if content differs.
This course allows students to apply advanced mathematical methods to practical, real-world problems. Projects are supervised individually by faculty members from the MAIT Program. The project's nature is flexible and determined jointly by the student and supervisor. A detailed final report must be prepared by the student and approved by the supervisor.

Mathematics (MATH)

MATH 401 Applications of Linear Algebra (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH461, MATH240, MATH341).
Various applications of linear algebra: theory of finite games, linear programming, matrix methods as applied to finite Markov chains, random walk, incidence matrices, graphs and directed graphs, networks and transportation problems.

MATH 402 Algebraic Structures (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461). Restriction: Must not be in any of the following programs (Mathematics (Master's); Mathematics (Doctoral)). Credit only granted for: MATH402 or MATH403.
For students having only limited experience with rigorous mathematical proofs. Parallels MATH403. Students planning graduate work in mathematics should take MATH403. Groups, rings, integral domains and fields, detailed study of several groups; properties of integers and polynomials. Emphasis is on the origin of the mathematical ideas studied and the logical structure of the subject.

MATH 403 Introduction to Abstract Algebra (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH340); and 1 course with a minimum grade of C- from (MATH341, MATH241); and minimum grade of C- in MATH310. Or students who have taken courses with comparable content may contact the department. Credit only granted for: MATH402 or MATH403.
Integers; groups, rings, integral domains, fields.

MATH 404 Field Theory (3 credits)
Prerequisite: MATH403.
Algebraic and transcendental elements, Galois theory, constructions with straight-edge and compass, solutions of equations of low degrees, insolubility of the quintic equation, Sylow theorems, fundamental theorem of finite Abelian groups.

MATH 405 Linear Algebra (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and minimum grade of C- in MATH310.
An abstract treatment of finite dimensional vector spaces. Linear transformations and their invariants.

MATH 406 Introduction to Number Theory (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH241, MATH246, MATH340, MATH341, MATH461); or permission of CMNS-Mathematics department.
Integers, divisibility, prime numbers, unique factorization, congruences, quadratic reciprocity, Diophantine equations and arithmetic functions.

MATH 410 Advanced Calculus I (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241); and minimum grade of C- in MATH310. Or students who have taken courses with comparable content may contact the department.
First semester of a year course. Subjects covered during the year are: sequences and series of numbers, continuity and differentiability of real valued functions of one variable, the Riemann integral, sequences of functions and power series. Functions of several variables including partial derivatives, multiple integrals, line and surface integrals. The implicit function theorem.

MATH 411 Advanced Calculus II (3 credits)
Prerequisite: Minimum grade of C- in MATH410; and permission of CMNS-Mathematics department. Credit only granted for: MATH411 or MATH412.
Continuation of MATH410.

MATH 412 Advanced Calculus with Applications (3 credits)
Prerequisite: Minimum grade of C- in MATH410; and permission of CMNS-Mathematics department. Credit only granted for: MATH411 or MATH412.
Analysis in several variables, and applications, from a computational perspective.

MATH 416 Applied Harmonic Analysis: An Introduction to Signal Processing (3 credits)
Prerequisite: Minimum grade of C- in MATH141; and 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and familiarity with MATLAB is required.
Introduces students to the mathematical concepts arising in signal analysis from the applied harmonic analysis point of view. Topics include applied linear algebra, Fourier series, discrete Fourier transform, Fourier transform, Shannon Sampling Theorem, wavelet bases, multiresolution analysis, and discrete wavelet transform.

MATH 420 Mathematical Modeling (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH241, MATH340); and 1 course with a minimum grade of C- from (MATH246, MATH341); and minimum grade of C- in STAT400. And 1 course with a minimum grade of C- from (CMSC106, CMSC131); or students who have taken courses with comparable content may contact the department. Also offered as: AMSC420. Credit only granted for: AMSC420 or MATH420.
The course will develop skills in data-driven mathematical modeling through individual and group projects. Emphasis will be placed on both analytical and computational methods, and on effective oral and written presentation of results.

MATH 424 Introduction to the Mathematics of Finance (3 credits)
Prerequisite: Minimum grade of C- in MATH141; and 1 course with a minimum grade of C- from (STAT400, STAT410); and permission of CMNS-Mathematics department.
Recommended: MATH246, MATH240, MATH241, MATH340, or MATH341. Credit only granted for: BMGT444, MATH424.
Introduction to the mathematical models used in finance and economics with emphasis on pricing derivative instruments. Designed for students in mathematics, computer science, engineering, finance and physics. Financial markets and instruments; elements from basic probability theory; interest rates and present value analysis; normal distribution of stock returns; option pricing; arbitrage pricing theory; the multiperiod binomial model; the Black-Scholes option pricing formula; proof of the Black-Scholes option pricing formula and applications; trading and hedging of options; Delta hedging; utility functions and portfolio theory; elementary stochastic calculus; Ito's Lemma; the Black-Scholes equation and its conversion to the heat equation.

MATH 430 Euclidean and Non-Euclidean Geometries (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461).
Hilbert's axioms for Euclidean geometry. Neutral geometry: the consistency of the hyperbolic parallel postulate and the inconsistency of the elliptic parallel postulate with neutral geometry. Models of hyperbolic geometry. Existence and properties of isometries.

MATH 431 Geometry for Computer Graphics (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH461, MATH240, MATH341).
Topics from projective geometry and transformation geometry, emphasizing the two-dimensional representation of three-dimensional objects and objects moving about in the plane and space. The emphasis will be on formulas and algorithms of immediate use in computer graphics.

MATH 432 Introduction to Topology (3 credits)
Prerequisite: Minimum grade of C- in MATH410.
Metric spaces, topological spaces, connectedness, compactness (including

Heine-Borel and Bolzano-Weierstrass theorems), Cantor sets, continuous maps and homeomorphisms, fundamental group (homotopy, covering spaces, the fundamental theorem of algebra, Brouwer fixed point theorem), surfaces (e.g., Euler characteristic, the index of a vector field, hairy sphere theorem), elements of combinatorial topology (graphs and trees, planarity, coloring problems).

MATH 436 Differential Geometry of Curves and Surfaces I (3 credits)

Prerequisite: MATH241 or MATH340; and (MATH461, MATH240, or MATH341); and must have completed two 400-level MATH courses (not including MATH461, 478, and 480's).

Curves in the plane and Euclidean space, moving frames, surfaces in Euclidean space, orientability of surfaces; Gaussian and mean curvatures; surfaces of revolution, ruled surfaces, minimal surfaces, special curves on surfaces, "Theorema Egregium"; the intrinsic geometry of surfaces.

MATH 437 Differential Forms (3 credits)

Prerequisite: MATH241 or MATH340; and (MATH461, MATH240, or MATH341). Recommended: MATH405, MATH403, MATH436, MATH410, or MATH432.

Introduction to differential forms and their applications, and unites the fundamental theorems of multivariable calculus in a general Stokes Theorem that is valid in great generality. It develops this theory and technique to perform calculations in analysis and geometry. Topics include an introduction to topological spaces, the Gauss-Bonnet Theorem, Gauss's formula for the linking number, and the Cauchy Integral Theorem. Applications include Maxwell's equations of electromagnetism, connections and gauge theory, and symplectic geometry and Hamiltonian dynamics.

MATH 445 Elementary Mathematical Logic (3 credits)

Prerequisite: Minimum grade of C- in MATH141.

Elementary development of propositional and predicate logic, including semantics and deductive systems and with a discussion of completeness, incompleteness and the decision problem.

MATH 446 Axiomatic Set Theory (3 credits)

Prerequisite: MATH403 or MATH410.

Development of a system of axiomatic set theory, choice principles, induction principles, ordinal arithmetic including discussion of cancellation laws, divisibility, canonical expansions, cardinal arithmetic including connections with the axiom of choice, Hartog's theorem, Konig's theorem, properties of regular, singular and inaccessible cardinals.

MATH 452 Introduction to Dynamics and Chaos (3 credits)

Prerequisite: Minimum grade of C- in MATH246; and 1 course with a minimum grade of C- from (MATH240, MATH461). Or minimum grade of C- in MATH340 and MATH341. Also offered as: AMSC452. Credit only granted for: AMSC452 or MATH452.

An introduction to mathematical dynamics and chaos. Orbits, bifurcations, Cantor sets and horseshoes, symbolic dynamics, fractal dimension, notions of stability, flows and chaos. Includes motivation and historical perspectives, as well as examples of fundamental maps studied in dynamics and applications of dynamics.

MATH 456 Cryptology (3 credits)

Prerequisite: Must have completed two 400-level MATH courses (not to include MATH 461, 478, and 480's) with a minimum grade of C-. Or minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Mathematics department. Also offered as: CMSC456. Credit only granted for: MATH456 or CMSC456.

Importance in protecting data in communications between computers. The subject lies on the border between mathematics and computer science. Mathematical topics include number theory and probability. Computer science topics include complexity theory.

MATH 461 Linear Algebra for Scientists and Engineers (3 credits)

Prerequisite: Minimum grade of C- in MATH141; and must have completed any MATH or STAT course with a prerequisite of MATH141. Credit only granted for: BIOE371, MATH240, MATH341, or MATH461. Additional information: This course may not be used towards the upper level math requirements for MATH/STAT majors.

Basic concepts of linear algebra. This course is similar to MATH 240, but with more extensive coverage of the topics needed in applied linear algebra: change of basis, complex eigenvalues, diagonalization, the Jordan canonical form.

MATH 462 Partial Differential Equations (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (MATH241, MATH340); and 1 course with a minimum grade of C- from (MATH246, MATH341).

Linear spaces and operators, orthogonality, Sturm-Liouville problems and eigenfunction expansions for ordinary differential equations. Introduction to partial differential equations, including the heat equation, wave equation and Laplace's equation. Boundary value problems, initial value problems and initial-boundary value problems.

MATH 463 Complex Variables for Scientists and Engineers (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (MATH241, MATH340).

The algebra of complex numbers, analytic functions, mapping properties of the elementary functions. Cauchy integral formula. Theory of residues and application to evaluation of integrals. Conformal mapping.

MATH 464 Transform Methods for Scientists and Engineers (3 credits)

Prerequisite: 1 course with a minimum grade of C- from (MATH246, MATH341).

Fourier transform, Fourier series, discrete fast Fourier transform (DFT and FFT). Laplace transform. Poisson summations, and sampling. Optional Topics: Distributions and operational calculus, PDEs, Wavelet transform, Radon transform and applications such as Imaging, Speech Processing, PDEs of Mathematical Physics, Communications, Inverse Problems.

MATH 470 Mathematics for Secondary Education (3 credits)

Prerequisite: MATH141 and MATH140; and must have completed one 400-level MATH course (not to include MATH461, 478, and 480's).

An advanced perspective on some of the core mathematics underlying high school mathematics courses. Topics include number systems, functions of one variable, equations, inequalities, trigonometric functions, curve fitting, and polynomials. The course includes an analysis of alternate approaches to mathematical ideas and problems, and makes connections between ideas that may have been studied separately in different high school and college courses.

MATH 475 Combinatorics and Graph Theory (3 credits)

Prerequisite: MATH240 or MATH341; and (MATH241 or MATH340); and permission of CMNS-Mathematics department. Also offered as: CMSC475. Credit only granted for: MATH475 or CMSC475.

General enumeration methods, difference equations, generating functions. Elements of graph theory, matrix representations of graphs, applications of graph theory to transport networks, matching theory and graphical algorithms.

MATH 478 Selected Topics For Teachers of Mathematics (1-3 credits)

Prerequisite: Permission of CMNS-Mathematics department. Additional information: Math majors may not use

this course to fulfill the upper-level math requirement.

MATH 480 Algebra for Middle School Teachers (3 credits)
Prerequisite: MATH214. Restriction: Must be a middle school teacher; and permission of CMNS-Mathematics department. Credit only granted for: MATH480 or MATH483. Additional information: Not applicable to MATH/STAT major or minor requirements.
Prepares teachers with elementary certification to teach Algebra 1 in middle school. Focuses on basic algebra concepts and related theoretical ideas.

MATH 481 Statistics and Data Analysis for Middle School Teachers (3 credits)
Prerequisite: MATH214. Restriction: Must be a middle school teacher; and permission of CMNS-Mathematics department. Credit only granted for: MATH481 or MATH485. Additional information: Not applicable to MATH/STAT major or minor requirements.
Prepares teachers with elementary certification to teach simple data analysis and probability in middle school. Focuses on understanding basic statistics, data analysis, and related theoretical ideas.

MATH 482 Geometry for Middle School Teachers (3 credits)
Prerequisite: MATH214. Restriction: Must be a middle school teacher; and permission of CMNS-Mathematics department. Credit only granted for: MATH482 or MATH484. Additional information: Not Applicable to MATH/STAT major or minor requirements.
Prepares teachers with elementary certification to teach geometry in middle school. Focuses on understanding basic geometry concepts and related theoretical ideas.

MATH 483 Algebra for High School Teachers (3 credits)
Prerequisite: MATH141. Restriction: Senior standing. Credit only granted for: MATH483 or MATH480. Additional information: May not be used towards the upper level math requirements for the MATH minor.
Focuses on concepts related to algebra and trigonometry, including functions, equations, inequalities, and data analysis. Assumes a good understanding of calculus.

MATH 484 Geometry for High School Teachers (3 credits)
Prerequisite: MATH141; or students who have taken courses with comparable content may contact the department. Restriction: Senior standing. Credit only granted for: MATH482, MATH484, or MATH498E. Formerly: MATH498E.
Focuses on concepts related to geometry, including several geometry axiom schemes, transformations, and similarity. Includes constructions with Geometer's Sketchpad.

MATH 485 Statistics for High School Teachers (3 credits)
Prerequisite: MATH141; or students who have taken courses with comparable content may contact the department. Credit only granted for: MATH481 or MATH485. Additional information: May not be used towards the upper level math requirements for the MATH minor.
Focuses on concepts related to statistics and data analysis, including probability, sampling, distribution of data, and inference.

MATH 486 Calculus for High School Teachers (3 credits)
Prerequisite: MATH141; and cannot be used toward the upper level math requirements for MATH/STAT majors.
Focuses on concepts related to one-variable calculus including limits, continuity, derivative, integrals, series, and applications of these topics.

MATH 487 Number for Middle Grades Teachers (3 credits)
Prerequisite: Must have admission to M.A. or M.Ed. with concentration in Mathematics Education; or permission of CMNS-Mathematics department. Restriction: This course may not be used towards the upper level math requirements for the MATH/STAT major. Credit only granted for: MATH487 or MATH498K. Formerly: MATH498K.
The rational number and proportional reasoning concepts developed in the middle grades and the larger mathematical context for these. Multiple representations of relationships, including verbal descriptions, diagrams, tables, graphs, and equations. Common misconceptions.

MATH 489 Research Interactions in Mathematics (1-3 credits)
Prerequisite: Permission of CMNS-Mathematics department. Repeatable to 10 credits if content differs.
Students participate in a vertically integrated (undergraduate, graduate and/or postdoctoral, faculty) mathematics research group. Format varies. Students and supervising faculty will agree to a contract which must be approved by the department. Up to three credits of MATH489 may be applied to the mathematics degree requirements. See the department's MATH489 online syllabus for further information.

MATH 498 Selected Topics in Mathematics (1-9 credits)
Repeatable to 9 credits if content differs.
Topics of special interest to advanced undergraduate students will be offered occasionally under the general guidance of the departmental committee on undergraduate studies.

MATH 598 Topics for Teachers Workshops (1-3 credits)
Restriction: Must be a school teacher; or permission of instructor.
Workshops offered to school teachers for enrichment in various topics in modern mathematics.

MATH 600 Abstract Algebra I (3 credits)
Prerequisite: MATH405 and MATH403; or students who have taken courses with comparable content may contact the department.
Groups with operators, homomorphism and isomorphism theorems, normal series, Sylow theorems, free groups, Abelian groups, rings, integral domains, fields, modules. Topics may include HOM (A,B), Tensor products, exterior algebra.

MATH 601 Abstract Algebra II (3 credits)
Prerequisite: MATH600.
Field theory, Galois theory, multilinear algebra. Further topics from: Dedekind domains, Noetherian domains, rings with minimum condition, homological algebra.

MATH 602 Homological Algebra (3 credits)
Prerequisite: MATH600.
Projective and injective modules, homological dimensions, derived functors, spectral sequence of a composite functor. Applications.

MATH 603 Commutative Algebra (3 credits)
Prerequisite: MATH600.
Ideal theory of Noetherian rings, valuations, localizations, complete local rings, Dedekind domains.

MATH 606 Algebraic Geometry I (3 credits)
Prerequisite: MATH600 and MATH601.
Prime and primary ideals in Noetherian rings, Hilbert Nullstellensatz, places and valuations, prevarieties (in the sense of Serre), dimension, morphisms, singularities, varieties, schemes, rationality.

MATH 607 Algebraic Geometry II (3 credits)
Prerequisite: MATH606.
Topics in contemporary algebraic

geometry chosen from among: theory of algebraic curves and surfaces, elliptic curves, Abelian varieties, theory of schemes, theory of zeta functions, formal cohomology, algebraic groups, reduction theory.

MATH 620 Algebraic Number Theory I (3 credits)

Prerequisite: MATH601.

Algebraic numbers and algebraic integers, algebraic number fields of finite degree, ideals and units, fundamental theorem of algebraic number theory, theory of residue classes, Minkowski's theorem on linear forms, class numbers, Dirichlet's theorem on units, relative algebraic number fields, decomposition group, inertia group and ramification group of prime ideals with respect to a relatively Galois extension.

MATH 621 Algebraic Number Theory II (3 credits)

Prerequisite: MATH600. And MATH620; or students who have taken courses with comparable content may contact the department.

Valuation of a field, algebraic function fields, completion of a valuation field, ramification exponent and residue class degree, ramification theory, elements, differents, discriminants, product formula and characterization of fields by the formula, Gauss sum, class number formula of cyclotomic fields.

MATH 630 Real Analysis I (3 credits)

Prerequisite: MATH411; or students who have taken courses with comparable content may contact the department.

Lebesgue measure and the Lebesgue integral on R, differentiation of functions of bounded variation, absolute continuity and fundamental theorem of calculus, Lp spaces on R, Riesz-Fischer theorem, bounded linear functionals on Lp, measure and outer measure, Fubini's theorem.

MATH 631 Real Analysis II (3 credits)

Prerequisite: MATH630.

Abstract measure and integration theory, metric spaces, Baire category theorem and uniform boundedness principle, Radon-Nikodym theorem, Riesz Representation theorem, Lebesgue decomposition, Banach and Hilbert Spaces, Banach-Steinhaus theorem, topological spaces, Arzela-Ascoli and Stone-Weierstrass theorems, compact sets and Tychonoff's theorem.

MATH 632 Functional Analysis (3 credits)

Prerequisite: MATH631.

Introduction to functional analysis and operator theory: normed linear spaces, basic principles of functional analysis, bounded linear operators on Hilbert spaces, spectral theory of selfadjoint operators, applications to differential and integral equations, additional topics as time permits.

MATH 634 Harmonic Analysis (3 credits)

Prerequisite: MATH630.

L1 theory: Fejer theorem, inversion theorem, ideal structure, Tauberian theorem. L2 theory: Plancherel-Parseval theorems, Paley-Wiener theorem. Lp theory: Hausdorff-Young theorem. Distribution theory: Bochner's theorem, Wiener continuous measures theorem, Malliavin theorem, Schwartz theory, almost periodic functions.

MATH 636 Representation Theory (3 credits)

Prerequisite: MATH631.

Introduction to representation theory of Lie groups and Lie algebras; initiation into non-abelian harmonic analysis through a detailed study of the most basic examples, such as unitary and orthogonal groups, the Heisenberg group, Euclidean motion groups, the special linear group. Additional topics from the theory of nilpotent Lie groups, semisimple Lie groups, p-adic groups or C-algebras.

MATH 642 Dynamical Systems I (3 credits)

Prerequisite: MATH432. And MATH630; or students who have taken courses with comparable content may contact the department.

Foundations of topological dynamics, homeomorphisms, flows, periodic and recurrent points, transitivity and minimality, symbolic dynamics. Elements of ergodic theory, invariant measures and sets, ergodicity, ergodic theorems, mixing, spectral theory, flows and sections. Applications of dynamical systems to number theory, the Weyl theorem, the distribution of values of polynomials, Vander Waerden's theorem on arithmetic progressions.

MATH 643 Dynamical Systems II (3 credits)

Prerequisite: MATH642; or students who have taken courses with comparable content may contact the department.

Entropy theory, variational principle for the entropy, expansiveness, measures with maximal entropy. Smooth systems on manifolds, diffeomorphisms and flows, periodic points, stable and unstable manifolds, homoclinic points, transversality, the Krupka-Smale theorem, Morse-Smale systems. Hyperbolicity, Anosov systems, distributions and foliations, strange attractors, Bowen's measure.

MATH 660 Complex Analysis I (3 credits)

Prerequisite: MATH410; or students who have taken courses with comparable content may contact the department.

Linear transformations, analytic functions, conformal mappings, Cauchy's theorem and applications, power series, partial fractions and factorization, elementary Riemann surfaces, Riemann's mapping theorem.

MATH 661 Complex Analysis II (3 credits)

Prerequisite: MATH630 and MATH660.

Topics in conformal mappings, normal families, Picard's theorem, classes of univalent functions, extremal properties, variational methods, elliptic functions, Riemann surfaces.

MATH 669 Selected Topics in Riemann Surfaces (1-3 credits)

Restriction: Permission of instructor. Repeatable to 99 credits if content differs.

Construction of Riemann surfaces, hyperbolic geometry, Fuchsian and Kleinian groups, potential theory, uniformisation spaces of meromorphic functions, line bundles, Picard variety, Riemann-Roch, Teichmueller theory.

MATH 670 Ordinary Differential Equations I (3 credits)

Prerequisite: MATH405. And MATH410; or students who have taken courses with comparable content may contact the department. Also offered as: AMSC670. Credit only granted for: AMSC670 or MATH670.

Existence and uniqueness, linear systems usually with Floquet theory for periodic systems, linearization and stability, planar systems usually with Poincare-Bendixson theorem.

MATH 671 Ordinary Differential Equations II (3 credits)

Prerequisite: MATH630. And MATH670 or AMSC670; or students who have taken courses with comparable content may contact the department. Also offered as: AMSC671. Credit only granted for: AMSC671 or MATH671.

The content of this course varies with the interests of the instructor and the class. Stability theory, control, time delay systems, Hamiltonian systems, bifurcation theory, and boundary value problems, and the like.

MATH 673 Partial Differential Equations I (3 credits)

Prerequisite: MATH411; or students who have taken courses with comparable content may contact the department. Also offered as: AMSC673. Credit only granted for: AMSC673 or MATH673.

Analysis of boundary value problems for Laplace's equation, initial value problems for the heat and wave equations. Fundamental solutions, maximum principles, energy methods. First order

nonlinear PDE, conservation laws. Characteristics, shock formation, weak solutions. Distributions, Fourier transform.

MATH 674 Partial Differential Equations II (3 credits)
Prerequisite: MATH673 or AMSC673; or permission of instructor. Also offered as: AMSC674. Credit only granted for: AMSC674 or MATH674.
Boundary value problems for elliptic partial differential equations via operator-theoretic methods. Hilbert spaces of functions. Duality, weak convergence. Sobolev spaces. Spectral theory of compact operators. Eigenfunction expansions.

MATH 689 Research Interactions in Mathematics (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
The students participate in a vertically integrated (undergraduate, graduate and/or postdoctoral, faculty) research group. Format varies, but includes regular meetings, readings and presentations of material. See graduate program's online syllabus or contact the graduate program director for more information.

MATH 695 Teaching Seminar (1 credits)
Restriction: Must be in one of the following programs (Mathematics (Doctoral); Mathematics (Master's); Mathematical Statistics (Doctoral); Applied Mathematics and Scientific Computation (Master's); Mathematical Statistics (Master's); Applied Mathematics and Scientific Computation (Doctoral)).
A course intended for first year teaching assistants. Topics include: everyday mechanics of teaching; teaching methods and styles; technology; course enrichment, diversity in the classroom; sexual harassment; teacher-student interactions; presentations by students.

MATH 712 Mathematical Logic I (3 credits)
Sentential logic, first-order languages, models and formal deductions. Basic model theory including completeness and compactness theorems, other methods of constructing models, and applications such as non-standard analysis.

MATH 713 Mathematical Logic II (3 credits)
Prerequisite: MATH712.
Incompleteness and undecidability results of Godel, Church, Tarski and others. Recursive function. Basic proof theory and axiomatic set theory.

MATH 730 Fundamental Concepts of Topology (3 credits)
Prerequisite: MATH403, MATH410, and MATH411; or students who have taken courses with comparable content may contact the department.
Survey of basic point set topology, fundamental group, covering spaces, Van Kampen's theorem, simplicial complexes, simplicial homology, Euler characteristics and classification of surfaces.

MATH 734 Algebraic Topology (3 credits)
Prerequisite: MATH403; or students who have taken courses with comparable content may contact the department. Recommended: MATH730.
Singular homology and cohomology, cup products, Poincare duality, Eilenberg-Steenrod axioms, Whitehead and Hurewicz theorems, universal coefficient theorem, cellular homology.

MATH 740 Fundamental Concepts of Differential Geometry (3 credits)
Prerequisite: MATH405, MATH411, and MATH730; or students who have taken courses with comparable content may contact the department.
Manifolds, tangent vectors and differential forms, Riemannian metrics, connections, curvature, structure equations, geodesics, calculus of variations.

MATH 742 Geometric Analysis (3 credits)
Prerequisite: MATH673 and MATH674; or MATH740.
Calculus of Variations, Bochner technique, Morse theory, weak solutions and elliptic regularity, maximum principle for elliptic and parabolic equations, Green's function of the Laplacian, isoperimetric and Sobolev inequalities, continuity method, curvature and comparison results, harmonic maps, curvature prescription problems.

MATH 744 Lie Groups I (3 credits)
Prerequisite: MATH405, MATH403, MATH411, and MATH432; or students who have taken courses with comparable content may contact the department.
An introduction to the fundamentals of Lie groups, including some material on groups of matrices and Lie algebras.

MATH 799 Master's Thesis Research (1-6 credits)

MATH 808 Selected Topics in Algebra (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

MATH 818 Selected Topics in Logic (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

MATH 848 Selected Topics in Geometry and Topology (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

MATH 858 Selected Topics in Analysis (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

MATH 868 SelectedTopics in Complex Analysis (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

MATH 898 Pre-Candidacy Research (1-8 credits)

MATH 899 Doctoral Dissertation Research (1-8 credits)

Marine-Estuarine-Environmental Sciences (MEES)

MEES 432 Physiological Ecology of Animals (3 credits)
Prerequisite: BSCI361; or students who have taken courses with comparable content may contact the department; or permission of instructor. Credit only granted for: MEES498E, MEES698E, MEES432, or MEES632. Formerly: MEES498E.
An examination of the influence of environmental constrains on animal function and energetic efficiency in the context of abiotic conditions in the habitats occupied by individuals.

MEES 498 Topics in Marine-Estuarine-Environmental Sciences (1-4 credits)
Lecture and/or laboratory series organized to study a selected area of marine-estuarine-environmental sciences not otherwise considered in formal courses.

MEES 604 Biometry (3 credits)
Credit only granted for: BIOM601, MEES604, MEES698B. Formerly: MEES698B.
Application of inferential statics to environmental data, design a sound

experiments and studies, and a working knowledge of R.

MEES 605 Energy and Environment (3 credits)
Prerequisite: MATH220; or students who have taken courses with comparable content may contact the department. Also offered as: ENST605. Credit only granted for: ENST405, ENST605, MEES605, or MEES698Z. Formerly: MEES698Z.
Role of energy in environmental and human-dominated systems and their linkage. Discussion of the historical and modern production and consumption of energy. Energy systems simulation modeling, energy analysis and energy auditing. Review of national energy policies and proposed alternatives.

MEES 606 Cell and Molecular Biology for Environmental Scientists (4 credits)
Prerequisite: An undergraduate course in cell biology or biochemistry. Credit only granted for: MEES698C or MEES606. Formerly: MEES698C.
An invisible world courses through every living thing. This is the world of molecules, tiny machines millions of time smaller than the machines we are most familiar with, like automobiles. Individually, each of the molecules is a delicate instrument, measuring, making, weighing, and building the thing we call life. The molecules of living things are unique among the molecules of the Earth. These tiny molecular messengers, engines, and machines are built to perform highly specific tasks unlike the molecules formed by physical processes.

MEES 607 Quantitative Methods in Environmental Sciences (3 credits)
Prerequisite: MATH220 and MATH221; or students who have taken courses with comparable content may contact the department. Credit only granted for: MEES607 or MEES698G. Formerly: MEES698G.
Mathematical approaches and solutions (both analytical and numerical) that cut across environmental disciplines, and will introduce analytical techniques.

MEES 608 Seminar in Marine-Estuarine-Environmental Sciences (1-2 credits)

MEES 610 Land Margin Interactions (4 credits)
Credit only granted for: MEES610 or MEES698I. Formerly: MEES698I.
Broad overview of the components and biogeochemistry of the coastal zone(atmosphere, land, streams, wetlands, estuaries) and the time and space scales on which interactions occur between components. Includes 4 h of classes per week with readings from the literature, field trips, a term paper, and a forum. Course is taught on the Interactive Video Network.

MEES 611 Estuarine Systems Ecology (3 credits)
Restriction: Permission of instructor.
A broad systems perspective on the important components and processes of estuarine ecosystems, with quantitative and/or mathematical treatment toward development of representative models for estuarine dynamics.

MEES 614 Landscape Ecology (4 credits)
Restriction: Permission of instructor.
Landscape ecology emphasizes spatial patterning--its causes, development, and importance for ecological processes. Students will become familiar with concepts, methods, and applications of landscape ecology through reading classic and contemporary literature representative of state-of-the-art research; class lectures; completion of two projects designed to provide "hands on" experience with some of the quantitative methods and tools; and completion of one independent project.

MEES 616 Fisheries Oceanography (3 credits)
Prerequisite: MEES661, AOSC670, MEES621, MEES631, MEES634, or MEES682; or permission of instructor. Credit only granted for: MEES698F or MEES616. Formerly: MEE698F.
Combines the disciplines of physical oceanography, biological oceanography and fisheries science to understand how environmental variability, ecosystems and humans influence harvested fish and shellfish populations. Physical-biological interactions from small-scale processes that influence individual larvae to basin-scale oscillations in climate that shift ecosystems.

MEES 617 Hydrological Effects of Land Use Change (3 credits)
Prerequisite: Statistics course and hydrology course or permission of instructor.
Detailed examination of the catchment-scale hydrological effects attributable to major land use and land cover alterations, including both anthropic and non-anthropic disturbances.

MEES 621 Biological Oceanography (4 credits)
Population and community ecology of estuarine and marine systems; coastal and estuarine processes are emphasized in the context of oceans in general. Field and lab trips required.

MEES 626 Environmental Geochemistry I (3 credits)
Recommended: Completion of one semester of physical chemistry is recommended. Restriction: Permission of instructor. Credit only granted for: MEES626 or MEES698L. Formerly: MEES698L.
Brief overview of biogeochemical cycles; fundamental aquatic chemistry that can be applied to a variety of environmental systems.

MEES 627 Environmental Geochemistry II (3 credits)
Prerequisite: MEES626; or permission of instructor. Credit only granted for: MEES627 or MEES698K. Formerly: MEES698K.
Detailed examination of aquatic geochemical cycles, including inorganic and organic geochemistry. Topics include global biogeochemical cycles, estuarine cycling, redox cycles, radiochemistry, stable isotope biogeochemistry and sediment biogeochemistry/diagenesis.

MEES 631 Fish Ecology (3 credits)
Restriction: Permission of instructor.
Study of the interrelationships between individuals, their communities and environment. Explores the environmental biology of fish, feeding ecology, energetics and growth, population biology, reproduction and life history, and population and community interactions.

MEES 632 Physiological Ecology of Animals (3 credits)
Credit only granted for: MEES698E, MEES498E, MEES432, MEES632. Formerly: MEES698E.
An examination of the influence of environmental constrains on animal function and energetic efficiency in the context of abiotic conditions in the habitats occupied by individuals.

MEES 634 Introduction to Bioenergetics and Population Dynamics (3 credits)
Credit only granted for: MEES634 or MEES698C. Formerly: MEES698C.
Bioenergetic and population dynamic processes as the individual and population levels; introduction to thermodynamic and bioenergetic principals that underlie patterns of energy partitioning in aquatic animals, the sources and fates of energy and demographic and life history consequences of surplus energy partitioning. Simple exponential and density dependent population growth, population-level production, interactions among populations; predator-prey, competition, and generalized Lotka-Volterra models are examined.

MEES 636 Marine Microbial Ecology Seminar (1 credits)
Prerequisite: Must have completed coursework in undergraduate microbiology and molecular biology. Credit only granted for: MEES608L or MEES636. Formerly: MEES608L.

Seminar course in which current papers from the literature on marine microbial ecology will be presented by students and critically analyzed. Molecular approaches will be emphasized.

MEES 637 Zooplankton Ecology (3 credits)
Prerequisite: MEES621; or permission of instructor. Credit only granted for: MEES698G, MEES637. Formerly: MEES698G.
A quantitative investigation of zooplankton ecology, emphasizing population dynamics and modeling, feeding, behavior, food-webs, and bio-physical interactions.

MEES 650 Wetland Ecology (3 credits)
Prerequisite: BIOM301; or permission of instructor. Also offered as: ENST450, ENST650. Credit only granted for: ENST450, ENST650, NRMT450, or MEES650.
Plant and animal communities, biogeochemistry, and ecosystem properties of wetland systems. Laboratory emphasizes collection and analysis of field data on wetland vegetation, soil, and hydrology.

MEES 652 Advanced Wetland Creation and Restoration (3 credits)
Prerequisite: BSCI106; and (BSCI362, ENST450, or MEES650). Or permission of CMNS-Marine & Estuarine-Environmental Science Prog. Also offered as: ENST452, ENST652. Credit only granted for: ENST452, ENST652, or MEES652.
Design, construction, and evaluation of wetlands restored or created for ecosystem enhancement or mitigation. Topics will include ecological restoration theory, goal-setting practices for establishing wetland hydrology, substrate, and vegetation, and restored ecosystem monitoring and functional assessment.

MEES 661 Physics of Estuarine and Marine Environments (3 credits)
Prerequisite: Must have completed one year of physics coursework; and must have completed one year of calculus coursework. Or permission of instructor.
General introduction to the physical oceanography of estuarine and marine systems. Physical characteristics of seawater, heat and mass transport, major ocean currents, basic dynamical oceanography, surface waves, tides, turbulence, sediment transport, estuarine circulation.

MEES 670 Conservation Biology (3 credits)
Also offered as: CONS670. Credit only granted for: CONS670 or MEES670.
Conservation in the Anthropocene means conserving biodiversity and ecosystem function in the midst of climate change, habitat loss, overexploitation, altered nutrient cycling, and invasive species with protected areas and reserve networks, ecosystem restoration, and other biodiversity conservation and management schemes.

MEES 671 Remote Sensing for Environmental Management (4 credits)
Credit only granted for: MEES671, MEES698X. Formerly: MEES698X.
Coverage of tools necessary to carry out remote sensing studies of ecosystem pattern and process, land-use and land-cover change and the impact of climate changes. General overview of recent research at the interface of remote sensing, ecosystem analysis, global change, and environmental management.

MEES 681 Advanced Ecological Design (3 credits)
Prerequisite: MATH220 and PHYS121; and (CHEM131; or students who have taken courses with comparable content may contact the department). Or permission of instructor. Also offered as: ENST481, ENST681. Credit only granted for: ENST481, ENST681, or MEES681.
An advanced survey course on the field of ecological design. Principles of design are illustrated with case studies from biologically-based waste treatment systems, ecosystem management and sustainable development.

MEES 682 Fishery Science and Management (3 credits)
Restriction: Permission of instructor.
Aquatic production and fisheries yields. Introduction to fish population dynamics and assessment methods. Effects of fishing on resource potential yields. Causes of fluctuations in resource abundance. An emphasis on the relationship between science and management.

MEES 698 Special Topics in Marine-Estuarine-Environmental Sciences (1-4 credits)
Credit according to time schedule and course organization. Lecture and/or laboratory series organized to study selected areas of environmental science not otherwise considered by existing courses. May be repeated for credit since topic coverage will change.

MEES 699 Special Problems in Marine-Estuarine-Environmental Sciences (1-3 credits)
Research on specialized topics under the direction of individual faculty members.

MEES 708 Advanced Topics in Marine-Estuarine-Environmental Science (1-4 credits)
Repeatable to 12 credits if content differs.
Lectures, experimental courses and other specialized graduate training in various relevant disciplines.

MEES 712 Advanced Population Dynamics and Assessment (4 credits)
Prerequisite: MEES607 or BIOM601; or permission of instructor. Credit only granted for: MEES698D or MEES712. Formerly: MEES698D.
Quantitative and modeling skills, including understanding of population dynamics and responses of populations to exploitation and management actions. Coverage of population models of production, mortality, stock and recruitment, age and growth, and harvesting, and methods for using these models to provide management advice.

MEES 743 Aquatic Toxicology (3 credits)
Comprehensive course in which a definitive description of basic concepts and principles, laboratory testing and field situations, as well as examples of typical data and their interpretation and use by industry and water resource managers, will be discussed. The toxicological action and fate of environmental pollutants will be examined in aquatic ecosystems, whole organisms and at the cellular, biochemical and molecular levels.

MEES 799 Masters Thesis Research (1-6 credits)

MEES 898 Pre-Candidacy Research (1-8 credits)

MEES 899 Doctoral Dissertation Research (1-8 credits)

Microbiology (MICB)

MICB 688 Special Topics (1-4 credits)
Prerequisite: Must have completed 20 credits in microbiology.
Presentation and discussion of fundamental problems and special subjects in the field of microbiology.

MICB 715 Advanced Topics in Microbial Pathogenesis (3 credits)
Prerequisite: BSCI424; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Current aspects of microbial pathogenesis. Topics include: how

microorganisms attach to and enter cells; how host cells are damaged by microbial products; how the host responds to invasion; and host-pathogen evolution. Primary literature readings will serve as the basis for lecture materials.

MICB 788 Seminar (1 credits)
First semester.

MICB 789 Seminar (1 credits)
Second semester.

MICB 799 Master's Thesis Research (1-6 credits)

MICB 898 Pre-Candidacy Research (1-8 credits)

MICB 899 Doctoral Dissertation Research (1-8 credits)

Maryland Institute for Applied Environmental Health (MIEH)

MIEH 400 Introduction to Global Health (3 credits)
Prerequisite: Minimum grade of C- in MIEH300. Restriction: Must be in Public Health Science program; or permission of SPHL-School of Public Health. And must have earned a minimum of 60 credits. Credit only granted for: MIEH400 or SPHL498A. Formerly: SPHL498A.
Exploration of theoretical frameworks and practical perspectives on issues shaping the global health panorama. Determinants examined through: biological and epidemiological; social, cultural and economic; environmental and geographic; multi-section, legal and institutional perspectives with synopsis of how these issues are addressed by international and community organizations in developing countries.

MIEH 480 Introduction to Occupational Health (3 credits)
Prerequisite: Minimum grade of C- in MIEH300. Recommended: BSCI201; and EPIB301. Restriction: Must be in a major in SPHL-School of Public Health.
An introduction to the field of occupational health and safety. Introduction to basic concepts in occupational safety and health, as well as the methods used to anticipate, recognize, evaluate, and control environmental factors or stresses arising in or from the workplace. In addition to instructor-led lectures, guest speakers will be invited to discuss case studies and/or discuss workplace hazards unique to specific populations.

MIEH 600 Foundations of Environmental Health (3 credits)
Credit only granted for: HLTH761 or MIEH600. Formerly: HLTH761.
Overview of the chemical, physical and biological hazards present in our living and working environment and their effects on human health. Topics include: exposure assessment, industrial hygiene and safety, pesticides, community and indoor pollution, food-borne diseases, solid and hazardous wastes, water resources, risk assessement, ecological issues and environmental laws.

MIEH 605 Fundamentals of Global Health (3 credits)
Credit only granted for: SPHL600 or SPHL698A. Formerly: SPHL698A.
Exploration of theoretical frameworks and practicial perspectives in global health with particular attention to the analysis of the biological, epidemiological, social, cultural and behavioral interactions that affect global health study and project implementation. The emphasis is on innovative solutions to health issues in underserved populations.

MIEH 610 Global Health Program Planning and Evaluation (3 credits)
Recommended: MIEH605. Credit only granted for: MIEH610, SPHL610 or SPHL698D. Formerly: SPHL698D and SPHL610.
Development of health program and evaluation plans to address critical health problems in international settings, especially transitional or in-conflict countries. Emphasis on linking a tactical program plan to overall health problems of a nation, to include the policy and economic issues involved in assessment, implementation and evaluation.

MIEH 620 Global Health Communication and Promotion (3 credits)
Recommended: MIEH605. Credit only granted for: SPHL620 or SPHL698C. Formerly: SPHL698C.
Explores the critical components in developing, implementing and evaluating health/population promotion and communication interventions. Emphasis is on theory application to a variety of cultural settings. Formative and quantitative research methods will be utilized.

MIEH 688 Seminar in the Maryland Institute for Applied Environmental Health: Current Topics in Environmental Health (1 credits)
Repeatable to 3 credits.
Invited and in-house research presentations from guest scientists, faculty members, and students, and critical analysis of journal articles on current topics in environmental and occupational health.

MIEH 720 Principles of Toxicology (3 credits)
Prerequisite: MIEH600.
Recommended: Must have completed some coursework in chemistry and/or biology.
Overview of toxicology, including exposure pathways, toxicokinetics, dermal toxicants, carcinogens, and genetic, reproductive, immuno-, nuero-, target organs, complex mixtures, structure-activity analysis, and determinants of hypo- and hyper-susceptibility. Case studies of global national and regional interest.

MIEH 721 Physiological Toxicology (3 credits)
Prerequisite: MIEH600.
Recommended: Must have completed coursework in chemistry, biology, biochemistry, and genetics.
Emphasis on macromolecular, metabolic, cellular, and physiologic targets of environmental contaminants and assays to detect toxic effects at these levels. Discussion of effects of select environmental toxicants in the context of their disruption of normal processes. Examination of the design of short-term assays and their desirable features to maximize usefulness for predicting human disease.

MIEH 722 Laboratory Methods in Environmental Health (3 credits)
Prerequisite: MIEH600.
Recommended: Must have completed coursework in analytical chemistry, microbiology, biochemistry.
Application of chemical principles to environmental monitoring. Basic sampling techniques and laboratory tests to determine chemical and microbiological pollutants in water, air and soil from field-collected samples.

MIEH 725 Environmental Analysis (3 credits)
Prerequisite: MIEH600.
Recommended: MIEH722.
Fundamentals of environmental chemistry and in environmental media (water, air, soil) and in biota. Theory of sampling, chemical analysis and quality control for major environmental contanimants. Introduction to spatial and statistical analysis, use of maps and Geographic Information Systems, and use of environmental anaylsis in remediation and pollution prevention.

MIEH 730 Environmental Justice, Built Environment, and Health Disparities (3 credits)
Prerequisite: Must have completed an Environmental Health course.
This course will give students the

opportunity to conduct an in-depth analysis of environmental justice and environmental racism in the United States and internationally. Students will synthesize their knowledge from environmental science courses with the concepts of civil rights and social justice to more fully understand the existing health disparities and how the built environment contributes to them.

MIEH 735 Food Toxicology (3 credits)

Recommended: BSCI440, CHEM131, or BCHM462. Also offered as: NFSC735. Credit only granted for: MIEH735 or NFSC735.

An introduction to basic concepts in toxicology in relation to toxic food contaminants and additives; both synthetic and naturally occurring. Focus on exposure routes, molecular targets and susceptible individuals. Also includes regulatory toxicology with respect food toxins.

MIEH 740 Environmental Health Risk Assessment (3 credits)

Prerequisite: MIEH600.

Review of the major methods of human and ecological risk assessment conducted by the U.S. Environment Protection Agency. Emphasis on sources of uncertainty.

MIEH 742 Principles of Industrial Hygiene (3 credits)

Prerequisite: MIEH600 and MIEH720.

Theory and practice of industrial hygiene, including major industrial exposures and their sampling and measurement. Focus on specific industries, work populations, and environments.

MIEH 750 Enviornmental Hazard Management (3 credits)

Prerequisite: MIEH600.

Overview of the stakeholders and processes of environmental management. Emphasis on theory and practice, including examination of diverse perspectives relating to environmental management from sceince, business, regulatory agencies, and the law. Analysis of successes and failures of actual enviornmental management cases at the state, regional, US, and global levels.

MIEH 760 Spatial Epidemiology (3 credits)

Prerequisite: Must have completed an Introduction biostatistics course. Recommended: Completion of a graduate epidemiology course, or environmental health course, or geography/GIS course.

The purpose of this survey course is to provide students with an introduction to spatial resources and methods specific to public health, with an emphasis on epidemiology and environmental applications. Students will be introduced to spatial resources, concepts, and tools relevant to public health research and practice. They will acquire skills to interpret, evaluate, and design basic public health spatial research projects; and to conduct simple spatial analyses.

MIEH 770 Law and Policy in Environmental Health (3 credits)

Prerequisite: MIEH600.

Overview of laws that affect the environment, and the various ways in which businesses are regulated by the government in the interest of protecting the environment. International, Federal, state, and local laws and regulations related to the protection of human health and the regulation of environmental containments, including biological, physicalanc chemical factors affecting community health. Examination of the interactions between and differing responsibilities of various agencies enforcing environmental laws and regulations.

MIEH 771 Exposure Assessment of Environmental Hazards (3 credits)

Prerequisite: MIEH600 and EPIB650.

Approaches and methods for determining exposure to environmental contaminants. Biomonitoring and genetic methods to detect recent exposures. Optimizing exposure assessment.

MIEH 773 Foodborne, Waterborne and Airborne Infectious Diseases (3 credits)

Corequisite: MIEH600.

In-depth study of foodborne, waterborne and airborne diseases caused by bacteria, viruses and parasites. Topics will include sources and detection of causative agents; their transmission to humans via food, water, air and other environmental media; and methods of disease prevention, including food safety approaches and drinking water treatment. Classes include lectures, discussions, field-trips and hands-on field sampling and laboratory activities.

MIEH 780 Occupational Health (3 credits)

Prerequisite: MIEH720, MIEH771, EPIB610, and EPIB650.

A synthesis of epidemiology, toxicology, exposure science, risk assessment, and policy. Emphasis will be on methods for anticipating, recognizing, evaluating and controlling workplace hazards; the hierarchy of controls; and current hot topics in occupational health.

MIEH 785 Internship in Public Health (3 credits)

Prerequisite: Permission of SPHL-Maryland Institute for Applied Environmental Health.

Internship and seminar providing an opportunity to apply previously acquired knowledge and skills in a health or allied health organization. Setting of the internship will depend upon the student's background and career goals.

MIEH 786 Captsone Project in Public Health (3 credits)

Prerequisite: Permission of SPHL-Maryland Institute for Applied Environmental Health.

Capstone experience provding opportunity to apply knowledge and skills to a specific public health problem or issue. Completion of project relevant to public health under the direction of an advisor.

MIEH 788 Critical Readings in Environmental Health (1-3 credits)

Prerequisite: MIEH600. Repeatable to 3 credits if content differs.

In-depth examination and critical discussion of the current literature relevant to environmental health.

MIEH 789 Independent Study (1-6 credits)

Prerequisite: Permission of SPHL-Maryland Institute for Applied Environmental Health.

Individual reading and/or research under a specific faculty member in the department.

MIEH 799 Master's Thesis Research (1-6 credits)

MIEH 899 Doctoral Dissertation Research (1-8 credits)

MPower Undergraduate Law Programs (MLAW)

MLAW 404 Law & Society Capstone: Implications of Technology on Law & Society (3 credits)

Restriction: Student must be enrolled in the Law and Society minor.

An exploration of the implications of technology on law and society from a variety of perspectives.Significant issues will be taken from contemporary scholarship and court cases.

Molecular and Cell Biology (MOCB)

MOCB 608 Molecular and Cell Biology Seminar (1-2 credits)

Repeatable to 5 credits if content differs.

Seminar in molecular and cell biology.

MOCB 639 Advanced Cell Biology (3 credits)
Repeatable to 6 credits if content differs.
Recent advances in key areas of modern cell biology.

MOCB 640 Protein Structure and Function (3 credits)
Protein structure, properties, and structure-function relationships.

MOCB 699 Laboratory Rotation (2-3 credits)
Prerequisite: Permission of CMNS-Molecular & Cell Biology Program (MCB). Restriction: Must be in one of the following programs (Cell Biology and Molecular Genetics (Doctoral); Cell Biology and Molecular Genetics (Master's)). Repeatable to 6 credits if content differs.
Laboratory experience in molecular-cell biology.

MOCB 708 Advanced Topics in Molecular and Cell Biology (1-4 credits)
Repeatable to 6 credits if content differs.
Lectures, experimental courses, and other special instructions in various areas of molecular or cell biology.

MOCB 898 Pre-Candidacy Research (1-8 credits)

MOCB 899 Doctoral Dissertation Research (1-8 credits)

Master of Software Engineering (MSWE)

MSWE 601 Issues in Software Engineering (3 credits)
An overview of the general process of software engineering, including an introduction to the following topics: systems engineering, software life cycle methods and techniques, software specification and analysis, software environments, databases, and software project management. Case studies will be used to consider specific software life cycle models and a software development project.

MSWE 603 Systems Engineering (3 credits)
Prerequisite: MSWE601.
An examination of the systems engineering process to include: an overview of system theory and structures, elements of the system life cycle (including systems design and development), risk and trade-off analyses, modeling and simulation, and the tools needed to analyze and support the systems process.

MSWE 605 Information Risk Assessment and Security Management (3 credits)
Prerequisite: MSWE601.
Threats of electronic intrusion into corporate information systems due to advances in computer and telecommunications technologies examined. Managing the risk associated with these threats in the design of applications and systems level software. Computer and telecommunications security challenges impacting the software engineering professional. Software design and cost, convenience and "user-friendliness". Key technical and management issues concerning security of public-switched network and corporate databases. Issues of risk and security related to software engineering within specific industries and government. How major technological advances in information technologies place corporate assets at risk. Quantitative and qualitative techniques for risk assessment and decision-making under uncertainty.

MSWE 609 A Quantitative Approach to Engineering Software (3 credits)
The engineering of software is presented via a continuous improvement paradigm for software development, using quantitative models of the various software processes, artifacts, and experiences, e.g. resources, defects. Software improvement and assessment paradigms are discussed. Experimentation, modeling building, and measurement approaches are presented.

MSWE 611 Software Specification and Analysis (3 credits)
Mathematical techniques for describing software systems, proving properties of a system's behavior prior to its implementation, and determining if the system has been correctly implemented. Description mechanisms for requirements and designs (state machines, Z), proof systems (natural deduction, term rewriting, model checking), static analysis (abstract interpretation, inspections, fault-tree analysis), dynamic analysis (test oracles, executable assertions, coverage metrics).

MSWE 615 Project Management (3 credits)
Project planning, organizing, and control; team building; project management styles; and ethics involved in project management are stressed. The organizational systems that support project operations, the difference between line and project management and project authority are examined. Emphasis is placed on the creativity and innovation involved in defining projects, designing technical performance measures, measuring cost effectiveness, and managing the project team. Project management microcomputer software will be used for creating the project plan and managing the project.

MSWE 617 Software Engineering Project (3 credits)
Prerequisite: Must have completed all core courses.
Laboratory experience in applying the software engineering techniques. Large-scale software development of novel applications systems.

Music Education (MUED)

MUED 411 Teaching Elementary Instrumental Music II (2 credits)
Prerequisite: MUED320 and MUED311. Corequisite: MUED489. Restriction: Must be in Music Education program.
Prepare instrumental-emphasis music education majors to synthesize the knowledge and skills that will enable them to develop and/or maintain an exemplary curricular-oriented, research-based, comprehensive elementary instrumental music program.

MUED 420 Teaching Secondary Instrumental Music II (2 credits)
Prerequisite: MUED320 and MUED311. Corequisite: MUED489. Restriction: Must be in Music Education program.
Prepare instrumental-emphasis music education majors to synthesize the knowledge and skills that will enable them to develop and/or maintain an exemplary, curricular-oriented, research-based, comprehensive secondary instrumental program.

MUED 471 Teaching General Music (2 credits)
Prerequisite: MUED222 and MUED333. Corequisite: MUED489. Restriction: Must be in Music Education program.
An examination of children's musical development via model teaching experiences. Students in this course will be involved in learning appropriate techniques and materials used to plan, deliver, and assess musical instruction effectively in general music settings for K-12 students. The focus is on how to implement a sequential, balanced, and comprehensive music curriculum (i.e., artistic processes: creating, performing, and responding) that emphasizes opportunities for students to construct their own learning.

MUED 472 Teaching Choral Music (2 credits)
Prerequisite: MUED471. Corequisite: MUED489. Restriction: Must be in

Music Education program.
Preparation for teaching choral classes through the integration of conducting technique, vocal pedagogy, knowledge of repertoire, and the application of appropriate instructional strategies in the context of peer teaching and field experience assignments.

MUED 473 Teaching General Music for Instrumentalists (2 credits)
Prerequisite: MUED311; and MUED320. Restriction: Must be in Music Education program.
Introduction to current trends, materials and approaches in general music instruction.

MUED 474 Field Experiences: Pre-Student Teaching (1 credits)
Prerequisite: MUED420 and MUED411; or (MUED472 and MUED471). Restriction: Permission of ARHU-School of Music department; and senior standing.
Field experiences to fulfill teaching requirements in K-12 music teacher education program.

MUED 484 Student Teaching in Elementary School: Music (4-6 credits)
Corequisite: MUED494. Restriction: Permission of ARHU-School of Music department; and must be in Music Education program.
Fulfills elementary teaching requirements in K-12 music teacher education program. Limited to music education majors who have previously applied.

MUED 489 Field Experiences (1 credits)
Restriction: Permission of ARHU-School of Music department; and must be in Music Education program. Repeatable to 6 credits.
Series of field experiences in K-12 settings.

MUED 494 Student Teaching in Secondary School: Music (4-6 credits)
Corequisite: MUED484. Restriction: Permission of ARHU-School of Music department; and must be in Music Education program.
Fulfill secondary teaching requirements in K-12 music teacher education program. Limited to music education majors who have previously applied.

MUED 499 Workshops, Clinics, Institutes (1-3 credits)
Repeatable to 6 credits if content differs.
Innovative and experimental dimensions of music education offered to meet the needs of music teachers and music supervisors allowing students to individualize their programs.

MUED 672 Advanced Instrumental Methods in Music Education (3 credits)
Restriction: Permission of ARHU-School of Music department.
Teaching instrumental music in the K-12 setting, including recruiting, literature selection, curriculum, rehearsal techniques, and pedagogical approaches.

MUED 673 Beginning String Instruction: Principles and Applications in Group Process (3 credits)
Restriction: Permission of ARHU-School of Music department.
A survey of string instrument techniques, pedagogy, and materials for the elementary school. Includes hands-on review and extension of beginning-level string playing and teaching techniques through an organized, sequential approach.

MUED 677 Advanced Studies in Choral Music Education (3 credits)
Restriction: Permission of ARHU-School of Music department.
A critical review of choral music education in both school and community. Includes historical foundations, philosophical perspectives, and practical teaching applications in light of current scholarship.

MUED 687 Music Cultures in the Classroom I: Philosophy and Curriculum Development (3 credits)
Restriction: Must be in a major within ARHU-School of Music department.
Development of music curriculum appropriate for teaching in culturally diverse schools. Formation of philosophical perspectives, structuring of curriculum model, identifying and sequencing curriculum content and assessing multicultural curricula.

MUED 688 Music Cultures in the Classroom II: Curriculum Materials and Teaching Strategies (3 credits)
Recommended: MUED687. Restriction: Must be in a major within ARHU-School of Music department. Repeatable to 9 credits if content differs.
Designed to assist the music teacher in integrating music from selected cultures into the curriculum. Curriculum materials are presented and teaching strategies demonstrated.

MUED 690 Research Methods in Music and Music Education (3 credits)
The application of methods of research to problems in the fields of music and music education. The preparation of bibliographies and the written exposition of research projects in the area of the student's major interest.

MUED 691 Psychology of Music Teaching and Learning (3 credits)
Restriction: Permission of ARHU-School of Music department.
An overview of the psychological bases of musical behavior, with particular emphasis on the teaching and learning of music.

MUED 692 Foundations and Perspectives of Music Education (3 credits)
Restriction: Permission of ARHU-School of Music department.
An introduction to historical, sociological, and philosophical perspectives of music education.

MUED 694 Learning Theory in Music (3 credits)
Restriction: Must be in a major within ARHU-School of Music department.
Exploration of learning theories and their application to music instruction. Study of music learning theory in crosscultural settings; application and evaluation in the context of a multicultural classroom.

MUED 695 Curriculum Development in Music Education (3 credits)
Restriction: Permission of ARHU-School of Music department.
Survey of curriculum movements, theories, methods, and materials in general education and in music education.

MUED 696 Assessment in Music Education (3 credits)
Restriction: Permission of ARHU-School of Music department.
Historical and theoretical nature of assessment in education. Application and critique of various materials and approaches to assessment in music education. Development of appropriate evaluation and reporting tools.

MUED 697 Curriculum & Assessment in Music Education (3 credits)
Theoretical and practical knowledge related to curriculum,assessment, and evaluation in music education. Course topics include: a) aspects of philosophy,sequencing, and design in music curricula; b) reliability, validity, and fairness in assessment; c) planning for and designing assessment of student knowledge and skills; d) policy, procedures, and outcomes associated with music teacher evaluation.

MUED 698 Current Trends in Music Education (1-3 credits)
Repeatable to 8 credits if content differs.
A survey of current and emerging philosophies, methodologies and curricula in music education and their implementation. The influence of educational and social changes and the expanding musical scene upon the music programs for children of all ages and for teacher education.

MUED 699 Workshops, Clinics, Institutes (1-3 credits)
Repeatable to 10 credits.
Innovative approaches to various dimensions of music education are offered to meet the pedagogical needs of music teachers. The maximum number of credits tht may be earned under this course symbol toward any degree is six semester hours; the symbol may be used two or more times unti sixsemester hours have been reached.

MUED 780 Seminar in Music Teacher Education (3 credits)
Restriction: Must have doctoral standing in a Music Education program.
Development of knowledge and skills necessary for music teacher educators. Topics include history of and reform movements in music teacher education, recruitment, education and certification of music teachers and inservice programs.

MUED 785 Teaching Music in Higher Education (3 credits)
Prepare students for music faculty positions in higher education institutions. The course readings, discussions, assignments, and experiences are aimed to develop the knowledge, skills, and dispositions necessary to be a successful member of the faculty at a variety of institutions.

MUED 790 Design and Analysis of Research in Music Education (3 credits)
Prerequisite: Must have completed a college-level statistics course. And MUED690; or an equivalent master's level research in music education course.
Advanced applications of quantitative and qualitative social science research paradigms to research problems in the field of music education. Topics include the formation of researchable questions; the design of experimental, quasi-experimental, descriptive, and qualitative research studies; and the analysis and interpretation of research data.

Music (MUSC)

MUSC 400 Music Pedagogy (3 credits)
Prerequisite: MUSP315; and permission of ARHU-School of Music department.
Conference course. A study of major pedagogical treatises in music, and an evaluation of pedagogical techniques, materials, and procedures.

MUSC 420 Introduction to Ethnomusicology (3 credits)
Prerequisite: MUSC210 and MUSC130; or permission of ARHU-School of Music department.
Restriction: Junior standing or higher.
Study of principal concepts and methods in ethnomusicology, covering history of field, linguistics and anthropology, music in various settings, musical cognition and ethnography of performance.

MUSC 428 Repertoire Coaching of Vocal or Chamber Music (2 credits)
Prerequisite: Must have completed or be concurrently enrolled in MUSC328.
A course for piano students who wish to go further than the work offered in MUSC128, MUSC228 and MUSC328 by becoming specialists in the areas of vocal coaching or chamber music coaching. Elements of pedagogy, conducting and responsible artistic decision-making for the entire musical production.

MUSC 430 The American Musical Experience: North America (3 credits)
Prerequisite: MUSC210 or MUSC130.
Restriction: Junior standing or higher.
Many musical styles found in North America portray the ideas and belief that characterize our diverse society. Specific problems and issues in American society examined through the American musical experience.

MUSC 432 Music in World Culture I (3 credits)
Prerequisite: MUSC130; or permission of ARHU-School of Music department.
Restriction: Junior standing or higher.
Musics of the Pacific and Asia analyzed in terms of musical, social and aesthetic interrelationships.

MUSC 433 Music in World Cultures II (3 credits)
Prerequisite: MUSC130; or permission of ARHU-School of Music department.
Restriction: Junior standing or higher.
Musics of Europe, Africa, and the Americas analyzed in terms of musical social and aesthetic interrelationships.

MUSC 435 Music of North America (3 credits)
Prerequisite: Permission of ARHU-School of Music department.
A survey of North American music from Colonial times to present.

MUSC 436 Jazz: Then and Now (3 credits)
Major styles and influential artists of the past 75 years of jazz.

MUSC 438 Area Studies in Ethnomusicology (3 credits)
Prerequisite: MUSC433 or MUSC432; or students who have taken courses with comparable content may contact the department. Repeatable to 9 credits if content differs.
Advanced study of musics in selected parts of the world.

MUSC 439 Collegium Musicum (1 credits)
Prerequisite: Permission of ARHU-School of Music department.
Repeatable to 5 credits.
Open to undergraduates and graduates, music majors and non-majors. Procurement, edition and performance of music not belonging to a standard repertory: early music, compositions for unusual performing media, works which demand reconstruction of their original circumstances of performance. Outcome of a semester's work may be one or more performances for the public.

MUSC 443 Solo Vocal Literature (3 credits)
Prerequisite: MUSC330 and MUSC331; or students who have taken courses with comparable content may contact the department.
The study of solo vocal literature from the Baroque Cantata to the Art Song of the present. The Lied, Melodie, vocal chamber music and the orchestral song are examined.

MUSC 444 Wind and Percussion Literature (1 credits)
Prerequisite: Permission of ARHU-School of Music department.
Corequisite: MUSP420 or MUSP419.
Recital program notes and written projects in wind or percussion literature.

MUSC 445 Survey of the Opera (3 credits)
Prerequisite: MUSC330 and MUSC331; or students who have taken courses with comparable content may contact the department.
A study of the music, librettos and composers of the standard operas.

MUSC 446 String Literature (1 credits)
Prerequisite: MUSP316; and permission of ARHU-School of Music department.
Recital program notes and written projects in string literature.

MUSC 448 Selected Topics in Music (1-3 credits)
Prerequisite: Permission of ARHU-School of Music department. Repeatable to 6 credits if content differs.

MUSC 450 Musical Form (3 credits)
Prerequisite: MUSC251.
A study of the principles of organization in music with emphasis on eighteenth and nineteenth century European music. Reading and analysis of scores exemplifying the musical forms.

MUSC 451 Analysis of Music (3 credits)
Prerequisite: MUSC450; or permission of instructor.
A course in the analysis of music. Discussion of individual works, with emphasis on their unique characteristics and on the relation of analysis to performance.

MUSC 453 Jazz Improvisation I (3 credits)
Prerequisite: MUSC251; or students who have taken courses with comparable content may contact the department. And permission of ARHU-School of Music department. Credit only granted for: MUSC345 or MUSC453. Formerly: MUSC345.
Jazz theory, notational conventions, improvisation techniques, reading and analysis of music, and performance in small combo format.

MUSC 454 Jazz Improvisation II (3 credits)
Prerequisite: MUSC453; or students who have taken courses with comparable content may contact the department. And permission of ARHU-School of Music department. Credit only granted for: MUSC346 or MUSC454. Formerly: MUSC346.
Continuation of MUSC453 including scoring and transcription.

MUSC 455 Theory of Jazz (3 credits)
Prerequisite: MUSC250; or permission of ARHU-School of Music department. Restriction: Must be in a major within ARHU-School of Music department.
Analysis of jazz harmony, with emphasis on principles of substitution, reharmonization, and syntax. Topics may also include chord/scale relationships, phrasing and articulation, notation, and introductory arranging concepts such as orchestration and form.

MUSC 456 Jazz Arranging (3 credits)
Prerequisite: MUSC455; and permission of ARHU-School of Music department. Credit only granted for: MUSC448N or MUSC456. Formerly: MUSC448N.
A comprehensive approach to jazz arranging. Topics to include chord scale theory, voicing techniques, part and score layout, and formal construction of an arrangement.

MUSC 460 Tonal Counterpoint I (3 credits)
Prerequisite: MUSC251; or permission of ARHU-School of Music department.
A course in Eighteenth-Century contrapuntal techniques, analysis and original composition of two-voice dances, preludes, and inventions. Includes an introduction to the study of fugue and canon.

MUSC 463 Applications in Music Technology (3 credits)
A hands-on study of computer hardware and software that makes use of the MIDI (Musical Instrument Digital Interface) specification. This protocol allows computers, synthesizers and various other devices to send and receive information about musical performance, notation and sound. The course focuses on two of the most frequently used applications on MIDI -- sequencing and music notation. Also included is an introduction to digital audio. No previous experience with computers is required. Ability to read music on a grand staff (treble and bass clef) is recommended.

MUSC 464 The Theories of Heinrich Schenker (3 credits)
Prerequisite: MUSC251 and MUSC450; and permission of ARHU-School of Music department. Restriction: Must not have completed MUSC651. Credit only granted for: MUSC464 or MUSC651.
An advanced analysis course in tonal music with specific emphasis on the theories of the early 20th century theorist Heinrich Schenker. Specific analyses of music by Bach, Mozart, Haydn, Beethoven, Chopin, and Brahms.

MUSC 467 Piano Pedagogy I (3 credits)
Prerequisite: Permission of ARHU-School of Music department.
A study of major pedagogical treatises in music, and an evaluation of pedagogical techniques, materials, and procedures.

MUSC 468 Piano Pedagogy II (3 credits)
Prerequisite: MUSC467; and permission of ARHU-School of Music department. Repeatable to 6 credits.
Application of the studies begun in MUSC467 to the actual lesson situation. Evaluation of results.

MUSC 469 Orchestral Excerpts for String Players (1 credits)
Restriction: Permission of ARHU-School of Music department. Repeatable to 6 credits if content differs. Credit only granted for: MUSC469, MUSC448B, MUSC448Q, MUSC448V, or MUSC448X. Formerly: MUSC448B, MUSC448Q, MUSC448V, and MUSC448X.
In-depth study of the orchestral excerpts required for professional orchestra auditions.

MUSC 470 Harmonic and Contrapuntal Practices of the Twentieth Century (3 credits)
Prerequisite: MUSC251; or students who have taken courses with comparable content may contact the department. And permission of ARHU-School of Music department.
A theoretical and analytical study of twentieth century materials.

MUSC 471 Contemporary Compositional Techniques (3 credits)
Prerequisite: MUSC470; and permission of ARHU-School of Music department.
Continuation of MUSC470, with emphasis on the analysis of individual works written since 1945.

MUSC 481 Music in the Renaissance (3 credits)
Survey of western music from 1450 to 1600.

MUSC 483 Music in the Classic Era (3 credits)
Survey of western music from 1750 to 1820.

MUSC 484 Music in the Romantic Era (3 credits)
Survey of western music from 1820 to 1900.

MUSC 485 Music in the 20th Century (3 credits)
Prerequisite: Permission of ARHU-School of Music department.
Survey of western music from 1900 to the present.

MUSC 486 Orchestration I (3 credits)
Prerequisite: MUSC251; and permission of ARHU-School of Music department.
A study of the ranges, musical functions and technical characteristics of the instruments and their color possibilities in various combinations. Practical experience in orchestrating for small and large ensembles.

MUSC 490 Conducting (2 credits)
Prerequisite: MUSC251.
Vocal and instrumental baton techniques.

MUSC 491 Conducting II (2 credits)
Prerequisite: MUSC490; or students who have taken courses with comparable content may contact the department.
Baton techniques applied to score reading, rehearsal techniques, tone production, style and interpretation.

MUSC 492 Keyboard Music I (3 credits)
Prerequisite: Permission of ARHU-School of Music department.
The history and literature of harpsichord and solo piano music from its beginning to the romantic period. Emphasis is placed on those segments of repertory which are encountered in performance and teaching situations at the present time.

MUSC 493 Keyboard Music II (3 credits)
Prerequisite: MUSC492; and permission of ARHU-School of Music department.
The history and literature of harpsichord and solo piano music from the Romantic period to the present. Emphasis is placed on those segments of repertory which are encountered in performance and teaching situations at the present time.

MUSC 499 Independent Studies (1-3 credits)
Prerequisite: Permission of ARHU-School of Music department. Additional information: May be repeated once for credit.
Independent research on a topic chosen in consultation with the instructor, which may culminate in a paper or appropriate project.

MUSC 550 Theory of Music Graduate Review (3 credits)
Restriction: Permission of ARHU-School of Music department.
Music theory review for graduate students:aural training, counterpoint, basic diatonic harmony, chromatic harmony, and analysis of complete works.

MUSC 601 Advanced English Lyric Diction (1 credits)
Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)) . And permission of instructor; or admission to graduate voice program.
Concepts, strategies and techniques for singing operatic, oratorio and song literature in English: stress patterns, linkage, stressed and non stressed vowels, dipthongs, placement of consonants and vowels, and communication of text with emphasis on current performance practices. Use of the International Phonetic Alphabet (IPA) will be stressed.

MUSC 602 Advanced Italian Lyric Diction (1 credits)
Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)) . And permission of instructor; or admission to graduate voice program.
Concepts, strategies and techniques for singing operatic and song literature in Italian: syllabification, vowels, stressed and unstressed syllables, dipthongs, glides and elisions, single and double consonants with emphasis on current performance practices.

MUSC 603 Advanced German Lyric Diction (1 credits)
Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)) . And permission of instructor; or admission to graduate voice program.
Concepts, strategies and techniques for singing operatic and song literature in German: single and double consonants, the use of the glottal, the German closed (e) and (o) vowels, the "schwa" and consonant clusters. Mastery of the International Phonetic Alphabet (IPA) as it applies to "Hochdeutsch" will be expected.

MUSC 604 Advanced French Lyric Diction (1 credits)
Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)) . And permission of instructor; or admission to graduate voice program.
Concepts, strategies and techniques for singing operatic and song literature in French: phoneticization, formation and singing of the vowel-sounds, semi-consonants, and consonants; the liaison; legato singing in French; the hiatus, mute and aspirate 'h'; stress and word rhythm. Use of the International Phonetic Alphabet (IPA) will be stressed.

MUSC 605 Opera Repertory I (1 credits)
Prerequisite: MUSC602; or permission of instructor. Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)).
Advanced vocal coaching of selections from the Italian, French, German, and English opera repertory: musical accuracy; language facility; diction clarity; and dramatic interpretation.

MUSC 606 Opera Repertory II (1 credits)
Prerequisite: MUSC605; or permission of instructor. Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)).
Continuation of MUSC 605. Advanced vocal coaching of selections from the Italian, French, German and English opera repertory: musical accuracy, language facility; diction clarity; and dramatic interpretation.

MUSC 608 Chamber Music Repertory (1-3 credits)
Repeatable to 99 credits. Additional information: May be repeated for credit to the maximum credit designated in the student's major degree program.
Prerequisite: graduate standing as a major in performance. A study, through performance, of diversified chamber music for standard media.

MUSC 609 Piano Chamber Music Practicum and Analysis (2 credits)
Restriction: Permission of ARHU-School of Music department.
Repeatable to 4 credits.
Study of repertoire written for piano in duos or with several instruments, to develop an accompanists advanced performance skills in listening, balance, nuance in dynamics, harmonic motion and phrasing.

MUSC 610 Research Methods, Bibliography, and Guided Writings (3 credits)
Survey of bibliographic material in ethnomusicology. Guided writing utilizing specific bibliography.

MUSC 611 Opera Techniques I (2 credits)
Corequisite: MUSC601. Restriction: Permission of director of opera; and must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)).
Techniques for opera performance: Improvisation; Acting I, Scene Study I; and Movement I. Practical application of styles and techniques to operatic repertoire.

MUSC 612 Opera Techniques II (2 credits)
Prerequisite: Minimum grade of B- in MUSC611. Corequisite: MUSC602. Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)) ; and permission of Director of Opera required.
Continuation of MUSC 611. Techniques for opera performance: Scene Study II; Movement II; and Mask.

MUSC 613 Opera Techniques III (2 credits)
Prerequisite: Minimum grade of B- in MUSC612; and permission of Director of Opera required. Corequisite:

MUSC603 and MUSC605. Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)).
Continuation of MUSC 612. Techniques for opera performance: Scene Study III; Movement III; and Shakespeare.

MUSC 614 Opera Techniques IV (2 credits)
Prerequisite: Minimum grade of B- in MUSC613. Corequisite: MUSC606 and MUSC604. Restriction: Must be in one of the following programs (Music - Doctoral (Doctoral); Music - Master (Master's)) ; and permission of Director of Opera required.
Continuation of MUSC 613. Techniques for opera performance: Scene Study IV and Movement IV.

MUSC 620 Analysis of World Music (3 credits)
Recommended: Completion of a seminar in transcription.
Development of skills for auditory analysis of diverse musical systems.

MUSC 621 Documents of Theory and Aesthetics: Ancient, Medieval and Renaissance (3 credits)
Writings about music in antiquity, the Middle Ages, and the Renaissance.

MUSC 629 Ensemble (1 credits)
Repeatable to 36 credits.
Rehearsal and performance of selected works for small and large instrumental ensembles.

MUSC 630 Seminar in Music Transcription (3 credits)
Advanced study of musical notations of the world; training in transcription of music

MUSC 631 Seminar in Organology (3 credits)
Restriction: Permission of ARHU-School of Music department.
Advanced study of musical instruments of the world, their morphology, musical and cultural function.

MUSC 632 The Anthropology of Music (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUET650 or MUSC632. Formerly: MUET650.
Explores how leading theoretical paradigms in socio-cultural anthropology have been incorporated into and shaped ethnomusicological research.

MUSC 633 Field Methods in Ethnomusicology I (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUET660 or MUSC633. Formerly: MUET660.
Introduction to a wide variety of methods and strategies for surveying, interviewing, and observing the dynamics of performance in contrasting settings. This is the first of three semesters of field methods.

MUSC 634 Field Methods in Ethnomusicology II (3 credits)
Prerequisite: MUSC660. Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUET661 or MUSC634. Formerly: MUET661.
Advanced training in field research techniques and issues including multimedia recording and data management, interview and survey techniques, grant writing, and research ethics.

MUSC 636 Field Methods in Ethnomusicology III (3 credits)
Prerequisite: MUSC634. Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUET662 or MUSC636. Formerly: MUET662.
Continuation of Field Methods in Ethnomusicology II. Further development of skills in data collection and interpretation, culminating in an urban musical ethnography project and document.

MUSC 639 Seminar in Music (3 credits)
Prerequisite: MUSC330 and MUSC331. Restriction: Permission of instructor. Repeatable to 99 credits if content differs.
The work of one major composer (Bach, Beethoven, etc.) will be studied.

MUSC 642 Early Music Notation (3 credits)
Aspects of notation in music before 1600; transcription into modern notation.

MUSC 643 Seminar in Solo Vocal Literature I (3 credits)
Prerequisite: MUSC443; or students who have taken courses with comparable content may contact the department.
An intensive study of solo vocal literature from its origin to the present.

MUSC 644 Seminar in Solo Vocal Literature II (3 credits)
Prerequisite: MUSC643; or students who have taken courses with comparable content may contact the department.
A continuation of MUSC 643 with an emphasis on areas of individual interest.

MUSC 645 Seminar in Vocal Pedagogy (3 credits)
Prerequisite: MUSC400; or students who have taken courses with comparable content may contact the department.
A study of the physiological, psychological and acoustical aspects of the teaching of singing combined with independent study and research in areas of individual interest.

MUSC 646 Introduction to Musicology (3 credits)
Prerequisite: Graduate student standing in in the School of Music. Credit only granted for: MUSC648 or MUSC646.
An introduction to the basics of musicological research, including sources, methodologies, and techniques, as well as the fundamentals of both academic and non-academic writing.

MUSC 648 Seminar in Music Research (3 credits)
Prerequisite: MUSC331.
An introduction to graduate study in the history and literature of music. Bibliography and methodology of systematic and historical musicology.

MUSC 649 Ensemble (1 credits)
Repeatable to 36 credits if content differs.

MUSC 651 The Theories of Heinrich Schenker (3 credits)
Prerequisite: MUSC450; or permission of ARHU-School of Music department.
The analytical methods of Heinrich Schenker with application of those theories to musical literature from the Baroque, Classical and Romantic periods.

MUSC 653 Jazz Improvisation I (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC653 or MUSC699Z. Formerly: MUSC699Z.
Study of improvisational techniques and historical styles of jazz, including study of jazz "language" through transcription and analysis of recorded solos, and the exploration of creative processes and philosophical concepts.

MUSC 654 Jazz Improvisation II (3 credits)
Prerequisite: MUSC653. Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC654 or MUSC699Z. Formerly: MUSC699Z.
Continuation of MUSC653, study of jazz improvisation techniques through analysis, transcription and composition.

MUSC 655 Theory of Jazz (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC655 ir MUSC699J. Formerly: MUSC699J.
Analysis of jazz harmony, with emphasis on principles of substitution, reharmonization, and syntax. Topics may also include chord/scale relationships, phrasing, articulation, notation and orchestration.

MUSC 656 Jazz Arranging (3 credits)
Prerequisite: MUSC655. Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC656 or MUSC699N. Formerly: MUSC699N.
Comprehensive approach to jazz arranging, including chord scale theory, voicing techniques, part and score layout, and formal construction of an arrangement.

MUSC 658 Seminar in Advanced Analysis (3 credits)
Prerequisite: MUSC651, MUSC451, and MUSC471; or permission of ARHU-School of Music department. Repeatable to 6 credits if content differs.
Individual analytical projects including computer music, non-western music and advanced Schenkerian analysis. Readings regarding form, structure and analytical methods.

MUSC 659 Seminar in Repertoire and Pedagogy (2-3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC659 or MUSC699R. Formerly: MUSC699R.
Analysis and preparation of choral master works from all major style periods for the purpose of successful rehearsal and performance by conductors.

MUSC 660 String Pedagogy (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC400S or MUSC660.
A study of major string pedagogical treatises, and an evaluation of string pedagogical techniques, materials, and procedures.

MUSC 661 Theory and Analysis of Atonal and Twelve-Tone Music (3 credits)
Prerequisite: MUSC450; or permission of ARHU-School of Music department. Credit only granted for: MUSC461, MUSC661, or MUSC699T. Formerly: MUSC699T.
An introduction to the advanced theroetical literature in atonal and twelve-tone music with an emphasison analytical applications to music but prominent 20th century composers.

MUSC 665 Theory in Analysis (3 credits)
Prerequisite: MUSC445; or permission of ARHU-School of Music department. Restriction: Must not have completed MUSC465. Credit only granted for: MUSC465, MUSC665, or MUSC699T. Formerly: MUSC699T.
An advanced study of the philosophy, practice, and aesthetics of music analysis in contemporary music thoery. Readings drawn from the theoretic literature from 1960 to the present emphasize standards for discourse, the objects of music analysis, rationales for interpretation, and the role that theories of musical structure play in analytic practice.

MUSC 669 Orchestral Excerpts for String Players (1 credits)
Restriction: Permission of ARHU-School of Music department. Repeatable to 6 credits. Credit only granted for: MUSC669, MUSC699B, MUSC699L, MUSC699Q, or MUSC699X. Formerly: MUSC699B,MUSC699L,MUSC699Q,and MUSC699X.
In-depth study of the orchestral excerpts required for professional orchestra auditions.

MUSC 670 Advanced Analytical Techniques I (3 credits)
Prerequisite: MUSC451; or permission of ARHU-School of Music department.
Analysis of representative masterpieces of the eighteenth and early nineteenth centuries.

MUSC 671 Advanced Analytical Techniques II (3 credits)
Prerequisite: MUSC451; or permission of ARHU-School of Music department.
Analysis of representative masterpieces of the nineteenth and early twentieth centuries.

MUSC 672 Masterworks of the 20th Century: 1900-1950 (3 credits)
Restriction: Permission of ARHU-School of Music department; and must not have completed MUSC470. Credit only granted for: MUSC448M, MUSC470, MUSC672, or MUSC699M. Formerly: MUSC699M.
A comprehensive survey of Western Art-Music of the first half of the 20th Century with a more intensive study and analysis of composers who have had a profound influence in the development of compositional practice in the modern era.

MUSC 673 Style Analysis (3 credits)
Prerequisite: MUSC251; and permission of ARHU-School of Music department. Restriction: Must not have completed MUSC448. Credit only granted for: MUSC673, MUSC448F, or MUSC699F. Formerly: MUSC699F.
An analytical study of musical style from the Middle Ages to present through analysis of selected compositions. The principle genres and composers of Medieval, Renaissance, Baroque, Classical, Romantic and 20th century music will be covered.

MUSC 675 Music Theory Pedagogy (3 credits)
Analysis of introductory level music theory courses, evaluation of text materials, and teaching approaches for music fundamentals, aural training, and basic undergraduate theory programs.

MUSC 676 Historical Theory and Method in Ethnomusicology (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUET675 or MUSC676. Formerly: MUET675.
Reading and discussion of major works in ethnomusicology, with emphasis on schools of thought, convergence with and divergence from musicology and systematic musicology; close examination of trends in methodology and theory from the mid-eighteenth century until approximately thirty years before the present.

MUSC 677 Current Theory and Method in Ethnomusicology (3 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUET676 OR MUSC677. Formerly: MUET676.
Reading and discussion of major works in ethnomusicology, with emphasis on a close examination of trends in methodology and theory from approximately twenty years before the present to current work in both areas. Current work in all geographic areas will be reviewed and analyzed.

MUSC 678 Seminar in Musical Composition (3 credits)
An advanced course in musical composition. May be repeated for credit.

MUSC 679 Seminar in Ethnomusicology (3 credits)
Repeatable to 9 credits if content differs. Formerly: MUET679.
Seminar topics address current issues, including gender, the social economy of music, ethnography of performance, etc.

MUSC 680 Seminar in Music of Antiquity and the Middle Ages (3 credits)
Research topics in music from antiquity to 1450.

MUSC 682 Seminar in Music of the Baroque Era (3 credits)
Seminar in music of the Baroque era. Research topics in music from 1600 to 1750.

MUSC 683 Seminar in Music of the Classic Era (3 credits)
Seminar in music of the Classic era. Research topics in music from 1750 to 1820.

MUSC 684 Seminar in Music of the Romantic Era (3 credits)
Seminar in music of the Romantic era. Research topics in music from 1820 to 1900.

MUSC 685 Seminar in Music of the 20th Century (3 credits)
Seminar in music of the twentieth century. Research topics in music from 1900 to the present.

MUSC 688 Advanced Orchestration (3 credits)
Prerequisite: MUSC487; or students who have taken courses with comparable content may contact the department. Additional information: May be repeated once for credit.
Orchestration projects in the styles of Debussy, Ravel, Stravinsky, Schoenberg, Bartok, and others.

MUSC 689 Advanced Conducting (2 credits)
Prerequisite: MUSC491; or students who have taken courses with comparable content may contact the department. Additional information: May be repeated for credit with permission of instructor.
A concentrated study of the conducting techniques involved in the repertoire of all historical periods.

MUSC 698 Advanced Seminar in Ethnomusicology (3 credits)
Prerequisite: Permission of ARHU-School of Music department. Restriction: Permission of ARHU-School of Music department. Repeatable to 9 credits if content differs. Credit only granted for: MUET689 or MUSC698. Formerly: MUET689.
Advanced Seminar on topics that change every semester. Requires well-developed skills in musical and social analysis, mastery of theories and methods of ethnomusicology.

MUSC 699 Selected Topics in Music (1-3 credits)
Restriction: Permission of ARHU-School of Music department. Repeatable to 6 credits if content differs.

MUSC 757 Aural Skills for Conductors (1 credits)
Restriction: Permission of ARHU-School of Music department.
Advanced musicianship skills necessary for conductors.

MUSC 758 Advanced Aural Skills for Conductors (1 credits)
Prerequisite: MUSC757. Restriction: Permission of ARHU-School of Music department. Repeatable to 4 credits.
Continuation of MUSC757, advanced aural skills necessary for conductors.

MUSC 799 Master's Thesis Research (1-6 credits)

MUSC 800 Advanced Seminar in Music Pedagogy (3 credits)
Prerequisite: MUSC400; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor.
A detailed study of historical and contemporary methods of pedagogy, and analysis of pedagogical problems. Sectioning by instrument. Required of all candidates for the D.M.A. Degree in performance and literature.

MUSC 801 Advanced Seminar in Music Pedagogy (3 credits)
Prerequisite: MUSC400; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor.
A detailed study of historical and contemporary methods of pedagogy, and analysis of pedagogical problems. Sectioning by instrument. Required of all candidates for the D.M.A. Degree in performance and literature.

MUSC 802 Advanced Seminar in Music Pedagogy III (3 credits)
Prerequisite: MUSC801. Restriction: Permission of ARHU-School of Music department.
A detailed study of historical and contemporary methods of pedagogy, and analysis of pedagogical problems. Sectioning by instrument.

MUSC 811 Doctoral Opera Techniques (2 credits)
Restriction: Permission of ARHU-School of Music department. Credit only granted for: MUSC611 or MUSC811.
Techniques for opera performance: Improvisation; Acting I, Scene Study I; and Movement I. Practical application of styles, techniques to operat e repertoire, and methodology seminar.

MUSC 812 Doctoral Opera Techniques II (2 credits)
Prerequisite: MUSC811; and permission of ARHU-School of Music department. Credit only granted for: MUSC612 or MUSC812.
Continuation of MUSC811. Techniques for opera preformance: Scene Study II; Acting II; Movement II: Stage Combat I; and Mask; and methodology seminar.

MUSC 813 Doctoral Opera Techniques III (2 credits)
Prerequisite: MUSC812; and permission of ARHU-School of Music department. Credit only granted for: MUSC613 and MUSC813.
Continuation of MUSC812. Techniques for opera performance: Scene Study III; Movement III; Acting III Shakespeare; Dance I; Stage Combat II; Stage Combat II; and methodology seminar.

MUSC 814 Doctoral Opera Techniques IV (2 credits)
Prerequisite: MUSC813; and permission of ARHU-School of Music department. Credit only granted for: MUSC614 or MUSC814.
Continuation of MUSC813. Techniques for opera performance: Scene Study IV; Dance II; Movement IV; and methodology seminar.

MUSC 830 Doctoral Seminar in Music Literature (3 credits)
Prerequisite: Must have completed at least twelve hours in music history and literature.
An analytical survey of the literature of music: keyboard music; vocal music; string music; wind instrument music; required of all candidates for the D.M.A. Degree in literature-performance.

MUSC 831 Doctoral Seminar in Music Literature (3 credits)
Prerequisite: MUSC830; or permission of ARHU-School of Music department.
An analytical survey of the literature of music: keyboard music; vocal music; string music; wind instrument music. Required of all candidates for the D.M.A. Degree in literature-performance.

MUSC 832 Doctoral Seminar in Music Literature (3 credits)
Prerequisite: MUSC831. Restriction: Permission of ARHU-School of Music department.
An analytical survey of the literature of music: keyboard music; vocal music; string music; wind instrument music.

MUSC 878 Advanced Composition (3 credits)
Prerequisite: MUSC678; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor. Repeatable to 99 credits.
Conference course in composition in the larger forms.

MUSC 898 Pre-Candidacy Research (1-8 credits)

MUSC 899 Doctoral Dissertation Research (1-8 credits)

Music Performance (MUSP)

MUSP 402 Music Performance (2 credits)
Senior course, in the minor series.

MUSP 403 Music Performance (2 credits)
Senior course, in the minor series.

MUSP 409 Music Performance (2-4 credits)
Senior course in the principal series.

MUSP 410 Music Performance (2-4 credits)
Senior course in the principal series. Recital required.

MUSP 419 Music Performance (2-4 credits)
Senior course in the major series.

MUSP 420 Senior Recital (4 credits)
Senior course in the major series. Recital required.

MUSP 609 Interpretation and Repertoire (2 credits)
Restriction: Permission of ARHU-School of Music department; and must have graduate standing in performance in the principal series.

MUSP 610 Graduate Music Performance (4 credits)
Prerequisite: MUSP609. Restriction: Permission of ARHU-School of Music department.

MUSP 619 Interpretation and Repertoire (2-4 credits)
Restriction: Must complete a Departmental audition; and permission of ARHU-School of Music department.
Prerequisite: departmental audition and permission of Department Chairman. Repeatable to a maximum of 12 credits.

MUSP 620 Graduate Music Performance (4 credits)
Prerequisite: MUSP619. Restriction: Permission of ARHU-School of Music department.
Prerequisite: MUSP 619 and permission of Department Chairman. Recital course in the major series.

MUSP 621 Interpretation, Repertoire, and Performance (2-4 credits)
Prerequisite: MUSP619. Corequisite: MUSC758. Restriction: Permission of ARHU-School of Music department.
Private music instruction in preparation for public performance.

MUSP 679 Practicum (1 credits)
Restriction: Permission of ARHU-School of Music department. Repeatable to 4 credits.
Private individual instruction on a secondary instrument.

MUSP 719 Interpretation and Repertoire (2-4 credits)
Restriction: Must complete a Departmental audition; and must be in the doctoral program in the major series; and permission of ARHU-School of Music department.
Prerequisite: departmental audition, admission to doctoral program in the major series and permission of department chairman. Repeatable to a maximum of 12 credits.

MUSP 815 Interpretation, Performance, and Pedagogy (4 credits)
Restriction: Must have Doctoral standing in performance; and permission of ARHU-School of Music department.
A seminar in pedagogy and the pedagogical literature for the doctoral performer, with advanced instruction at the instrument, covering appropriate compositions. Required of all candidates for the D.M.A. Degree in literature-performance. Prerequisite: doctoral standing in performance and permission of department chairman. Recital course.

MUSP 816 Interpretation, Performance, and Pedagogy (4 credits)
Prerequisite: MUSP815. Restriction: Permission of ARHU-School of Music department.
Recital course. Prerequisite: MUSP 815 and permission of Department Chairman.

MUSP 817 Interpretation, Performance, and Pedagogy (4 credits)
Prerequisite: MUSP816. Restriction: Permission of ARHU-School of Music department.
Recital course. Prerequisite: MUSP 816 and permission of Department Chairman.

MUSP 898 Pre-Candidacy Research (1-8 credits)

MUSP 899 Doctoral Dissertation Research (1-8 credits)

Neuroscience and Cognitive Science (NACS)

NACS 600 Ethics in Scientific Research (2 credits)
Prerequisite: Must have completed a year of graduate study. Restriction: Permission of instructor; and must be in Neurosciences and Cognitive Sciences (Doctoral) program. Credit only granted for: NACS600, PSYC788B, or BIOL600.
Issues of scientific integrity with emphasis on investigators in the laboratory sciences, including mentoring, scientific record keeping, authorship and peer review, ownership of data, use of animals and humans in research, and conflict of interest.

NACS 608 Neuroscience and Cognitive Science Seminar (1 credits)
Restriction: Permission of instructor. Repeatable to 8 credits if content differs.
Special seminar topics in Neuroscience and Cognitive Science.

NACS 640 Foundational Readings Seminar (2 credits)
Credit only granted for: NACS640 or NACS728R. Formerly: NACS728R.
An introduction to the breadth of research in Neuroscience and Cognitive Science. Faculty will present papers to provide historical context and introduction to important issues in the fields of their research.

NACS 641 Introduction to Neurosciences (4 credits)
Restriction: Permission of instructor.
Detailed examination of neurophysiology and sensorimotor systems.

NACS 642 Cognitive Neuroscience (4 credits)
A study of the fundamental concepts and techniques of cognitive neuroscience.

Hands-on experience with three critically different cognitive neuroscience methods: EEG, MEG, and fMRI.

NACS 643 Computational Neuroscience (4 credits)
Prerequisite: NACS641; and must have completed a course in calculus; and permission of instructor.
Provides a mathematical foundation in computational neuroscience.

NACS 644 Cellular and Molecular Neuroscience (4 credits)
Prerequisite: NACS641; or permission of instructor.
Overview of insights into the molecular mechanisms underlying the structure and function of the nervous system.

NACS 645 Cognitive Science (4 credits)
Credit only granted for: NACS645 or NACS728Y. Formerly: NACS728Y.
A study of mental representations and computations. Issues examined include computation, representations, decisions, modularity, evolution, innateness, and reductionism.

NACS 728 Selected Topics in Neuroscience and Cognitive Science (2-4 credits)
Restriction: Permission of BSOS-Dean-Neuroscience and Cognitive Science. Repeatable to 15 credits if content differs.
Graduate seminar on selected topics in contemporary neuroscience and Cognitive science. Extensive readings from the primary literature. Topics vary by semester.

NACS 798 Master's Non-Thesis Research (1-3 credits)
Restriction: Must be in Neurosciences and Cognitive Sciences (Doctoral) program. Repeatable to 6 credits.
Individual research course for NACS non-thesis MS degree

NACS 799 Master's Thesis Research (1-3 credits)
Restriction: Must be in Neurosciences and Cognitive Sciences (Doctoral) program. Repeatable to 6 credits.
Individualized research course for NACS thesis MS degree

NACS 898 Pre-Candidacy Research (1-8 credits)

NACS 899 Doctoral Dissertation Research (1-8 credits)
Restriction: Must be in Neurosciences and Cognitive Sciences (Doctoral) program.
Indivdual instruction course: contact department or instructor to obtain section number

Nutrition and Food Science (NFSC)

NFSC 410 Nutritional Genomics (3 credits)
Prerequisite: NFSC440; or permission of AGNR-Nutrition and Food Science department.
The emerging discipline of nutritional genomics, also known as nutrigenomics, is the study of effects of diet on the activity of an individual's genes and health, and the study of how different genetic variations affect nutrient metabolism. This course is designed to acquaint the students with current concepts, knowledge and strategies for understanding nutritional genomics.

NFSC 412 Food Processing Technology (4 credits)
Prerequisite: CHEM241, CHEM242, NFSC431, NFSC414, and NFSC434. Corequisite: NFSC421 and NFSC423. Recommended: MATH220.
Provides in-depth study of the major industrial modes of food preservation. It integrates aspects of the biology, microbiology, biochemistry and engineering disciplines as they relate to food processing technology and food science.

NFSC 414 Mechanics of Food Processing (4 credits)
Prerequisite: PHYS121. Credit only granted for: ENBE414 or NFSC414. Formerly: ENBE414.
Applications in the processing and preservation of foods, of power transmission, hydraulics, electricity, thermodynamics, refrigeration, instruments and controls, materials handling and time and motion analysis.

NFSC 421 Food Chemistry (3 credits)
Prerequisite: BCHM461.
Basic chemical and physical concepts are applied to the composition and properties of foods. Emphasis on the relationship of processing technology to the keeping quality, nutritional value, and acceptability of foods.

NFSC 422 Food Product Research and Development (3 credits)
Restriction: Senior standing; and must be in a major within AGNR-Nutrition and Food Science department; and permission of AGNR-Nutrition and Food Science department. Formerly: FDSC422.
A capstone course for FDSC majors. A study of the research and development of new food products. Application of food technology, engineering, safety and packaging are integrated by teams of students to develop a new food product from concept to pilot plant scale-up. Students will travel to nearby food processing plants on two to four Saturdays during the semester.

NFSC 423 Food Chemistry Laboratory (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in NFSC421.
Analysis of the major and minor constituents of food using chemical, physical and instrumental methods in concordance with current food industry and regulatory practices. Laboratory exercises coincide with lecture subjects in NFSC421.

NFSC 425 International Nutrition (3 credits)
Prerequisite: Must have completed one course in basic nutrition.
Nutritional status of world population; consequences of malnutrition on health and mental development; and local, national, and international programs for nutritional improvement.

NFSC 430 Food Microbiology (3 credits)
Prerequisite: BSCI223; or permission of instructor. Credit only granted for: ANSC430 or NFSC430. Formerly: FDSC430.
A study of microorganisms of major importance to the food industry with emphasis on food-borne outbreaks, public health significance, bioprocessing of foods, disease control, and the microbial spoilage of foods.

NFSC 431 Food Quality Control (4 credits)
Definition and organization of the quality control function in the food industry; preparation of specifications; statistical methods for acceptance sampling; in-plant and processed product inspection. Instrumental and sensory methods for evaluating sensory quality, identity and wholesomeness and their integration into grades and standards of quality. Statistical Process Control (SPC).

NFSC 434 Food Microbiology Laboratory (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in NFSC430. Credit only granted for: NFSC434 or ANSC434. Formerly: FDSC434.
A study of techniques and procedures used in the microbiological examination of foods.

NFSC 440 Advanced Human Nutrition (4 credits)
Prerequisite: BCHM462, BSCI440, and NFSC100; and permission of AGNR-

Nutrition and Food Science department.
A critical study of physiologic, molecular and metabolic influences on utilization of carbohydrates, lipids, proteins, vitamins, macro-and micro- minerals, and nonnutritive components of food. Interactions of these nutrients and food components will be examined relative to maintaining health.

NFSC 450 Food and Nutrient Analysis (3 credits)

Prerequisite: BCHM461 and NFSC100. Formerly: NUTR450.
Methods and practices of the analysis of foods and nutrients. An overview of the principles and basic mechanisms used in many of the analytical procedures commonly used in food and nutrition research. Emphasis will be placed on hands-on development of skills necessary to complete each analytical procedure; and on the accurate and concise description of the methodology and results from their application and on the regulations governing food analysis for nutritional labeling.

NFSC 460 Medical Nutrition Therapy (4 credits)

Prerequisite: NFSC380 and NFSC440; and permission of AGNR-Nutrition and Food Science department. Formerly: NUTR460.
Modifications of the normal adequate diet to meet human nutritional needs in acute and chronic diseases and metabolic disorders.

NFSC 468 Practicum in Nutrition (1-6 credits)

Prerequisite: Permission of AGNR-Nutrition and Food Science department. Repeatable to 6 credits if content differs. Formerly: NUTR468.
In-service training and practical experience in the application of the principles of normal and/or therapeutic nutrition in an approved community agency, clinical facility or nutrition research laboratory.

NFSC 470 Community Nutrition (3 credits)

Prerequisite: NFSC315; and permission of AGNR-Nutrition and Food Science department. Formerly: NUTR470.
Perspectives underlying the practice of nutrition services in community settings. Assessment of needs, program planning and evaluation. Programs and strategies to meet nutrition needs outside the acute care setting, such as nutrition education and food assistance. National nutrition policy and federal initiatives in nutrition will be examined. Students will be required to travel to local community nutrition sites during the semester.

NFSC 490 Special Problems in Nutrition (2-3 credits)

Prerequisite: NFSC440; and permission of AGNR-Nutrition and Food Science department.
Individually selected problems in the area of human nutrition.

NFSC 491 Issues and Problems in Dietetics (3 credits)

Prerequisite: NFSC350; and permission of AGNR-Nutrition and Food Science department. Corequisite: NFSC460. Restriction: Senior standing or higher; and must be in Nutrition and Food Science: Dietetics program.
A capstone course for dietetics majors. Students will integrate knowledge and theory of nutrition, food, management, psychology, and social behaviors necessary to support quality dietetic practice. Working in teams, students will participate in case studies, simulated situations and community projects. Individuals and groups will present cases as well as papers on published research.

NFSC 498 Selected Topics (1-3 credits)

Restriction: Permission of AGNR-Nutrition and Food Science department. Repeatable to 6 credits if content differs.
Selected current aspects of food.

NFSC 605 Food-Related Behavior of the Individual (3 credits)

Restriction: Permission of AGNR-Nutrition and Food Science department. Formerly: FOOD670.
Examination of the factors that influence food-related behavior and of the research methods used.

NFSC 610 Molecular Gerontology (3 credits)

Prerequisite: BCHM461 and BCHM463; or students who have taken courses with comparable content may contact the department. Recommended: BCHM462 or BCHM465.
This course is designed to acquaint the students with current knowledge of the molecular aspect of the aging process, with focuses on the genome, mechanisms of age-related degeneration, and molecular nutrition.

NFSC 611 Molecular Nutrition: Genomic, Metabolic, and Health Aspects (2 credits)

Recommended: BCHM461, NFSC440, or BCHM463.
The emerging discipline of molecular nutrition encompasses nutritional biochemistry, nutritional genomics, nutritional metabolomics, and epigenetics. It focuses on the effects of diet and nutrients on an individual's genome and metabolism, and how the molecular events affect human health. This is a co-taught course together with National Taiwan University via videoconferencing.

NFSC 620 Diet and Cancer Prevention (3 credits)

Prerequisite: NFSC440; or permission of instructor. Credit only granted for: NFSC620 or NFSC679D. Formerly: NFSC678D.
1. The nature of cancer and the relationship between dietary/nutritional factors and incidence of cancer 2. Basic concepts of general cancer biology with focus on effects of dietary components on genes and their encoded proteins, epigenetic changes and cell signaling 3. Effect of dietary factors in various types of cancer with respect to the benefit of intervention strategies for chemoprevention 4. Scientific knowledge, critical thinking, and the practical application of diet in cancer prevention.

NFSC 630 Nutritional Aspects of Energy Balance (3 credits)

Formerly: NUTR630.
The prevalence and basic causes of caloric imbalance, along with a wide variety of approaches to weight control.

NFSC 631 Advanced Food Microbiology (3 credits)

Prerequisite: NFSC430. Restriction: Permission of instructor.
One lecture and one laboratory period a week. An in-depth understanding and working knowledge of a selected number of problem areas and contemporary topics in food microbiology.

NFSC 633 Food Polymer Science (3 credits)

Prerequisite: Permission of instructor. Credit only granted for: NFSC633 or NFSC679P. Formerly: NFSC679P.
Food polymers including protein and carbohydrate from food, and their chemical, physical, and functional properties together with their structure-function relationship will be discussed. Food polymer applications in food and non-food areas will be covered. Principles and applications of instrumental methods for polymer characterization will be introduced. An emphasis on nanotechnology and its application to design and characterization food polymers will be included.

NFSC 650 Nutrition and Public Health (2 credits)

Prerequisite: NFSC470. Restriction: Permission of AGNR-Nutrition and Food Science department.
Overview of the major policy debates involving nutrition and health in the U.S. Public Health System associated with nutrition, chronic disease and nutrition lifestyle stages will be discussed. The CDCynergy software program will facilitate

the development of program design, implementation and evaluation skills.

NFSC 655 Nutrition, Food and Public Policy (3 credits)
Formerly: NUTR655.
History and current status of legislation relative to nutrition and food. Focus on gaining insights and skills regarding working effectively in the area of nutrition and policy.

NFSC 660 Research Methods (3 credits)
Prerequisite: Must have completed one statistics course. Formerly: NUTR 660.
A study of appropriate research methodology and theories including experimental design. Each student is required to develop a specimen research proposal.

NFSC 675 Nutritional Epidemiology (3 credits)
Prerequisite: NFSC440. Corequisite: BIOM602. Formerly: NUTR675.
Discussion of definition, history, relevance, and application of nutritional epidemiology to national and international nutrition problems. Exposure to skills and methodological tools used in nutritional epidemiology. Practical examples of epidemiologic studies also performed.

NFSC 678 Selected Topics in Nutrition (1-6 credits)
Repeatable to 6 credits. Formerly: NUTR678.
Individual or group study in an area of nutrition.

NFSC 679 Selected Topics in Food Science (1-6 credits)
Repeatable to 6 credits if content differs.
Individual or group study in an area of food science.

NFSC 680 Human Nutritional Status (3 credits)
Prerequisite: Must have complete coursework in advanced nutrition, biochemistry and physiology.
Indirect and direct methods of appraisal of human nutritional status which include: dietary, anthropometric, clinical evaluations and biochemical measures.

NFSC 688 Seminar in Nutrition and Food Science (1-3 credits)
Restriction: Must be in a major within AGNR-Nutrition and Food Science department. Repeatable to 3 credits. Formerly: NUTR688.
This is a seminar course presentedy by NFSC graduate students and invited speakers in the field of nutrition and food science.

NFSC 690 Nutrition and Aging (3 credits)
Prerequisite: NFSC440 or BSCI440; or students who have taken courses with comparable content may contact the department.
Explore the nutrition needs of older adults and examine the potential impact of the physiological, social and psychological changes that occur with aging on the needs.

NFSC 698 Colloquium in Food Science (1 credits)
Formerly: FDSC698.
Oral reports on special topics or recently published research in food science and technology. Distinguished scientists are invited as guest lecturers. A maximum of three credits allowed for the M.S.

NFSC 699 Problems in Nutrition and Food Science (1-4 credits)
Restriction: Permission of AGNR-Nutrition and Food Science department. Formerly: FDSC 699 and NUTR 699.
Credit according to time scheduled and magnitude of problem. An experimental program on a topic other than the student's thesis problem will be conducted. Four credits shall be the maximum allowed toward an advanced degree.

NFSC 735 Food Toxicology (3 credits)
Recommended: BCHM462, BSCI440, or CHEM131. Also offered as: MIEH735. Credit only granted for: MIEH735 or NFSC735.
An introduction to basic concepts in toxicology in relation to toxic food contaminants and additives; both synthetic and naturally occurring. Focus on exposure routes, molecular targets and susceptible individuals. Also includes regulatory toxicology with respect food toxins.

NFSC 799 Master's Thesis Research (1-6 credits)
Formerly: FDSC 799, NUSC 799, and NUTR 799.
First and second semesters. Credit in proportion to work done and results accomplished. Investigation in some phases of foodservice administration which may form the basis of a thesis. results in the form of a thesis.

NFSC 898 Pre-Candidacy Research (1-8 credits)
Formerly: NUSC898.
First and second semesters. Oral reports on special topics or recently published research in nutrition. Distinguished scientists are invited as guest lecturers. A maximum of three credits allowed for the M.S.

NFSC 899 Doctoral Dissertation Research (1-8 credits)
Formerly: FDSC 899, NUSC 899, and NUTR 899.

Natural Resources Sciences (NRSC)

NRSC 602 Advanced Crop Breeding II (2 credits)
Credit only granted for: AGRO602 or NRSC602. Formerly: AGRO602.
Quantitative inheritance in plant breeding including genetic constitution of a population, continuous variation, estimation of genetic variances, heterosis and inbreeding, heritability, and population movement.

NRSC 608 Research Methods (1-4 credits)
Restriction: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 4 credits if content differs. Credit only granted for: AGRO608 or NRSC608. Formerly: AGRO608.
Development of research viewpoint by detailed study and report on crop and soil research of the Maryland Agriculture Experiment Station or review and discussion of literature on specific agricultural problems or new research techniques.

NRSC 609 Integrated Pest Mangement (1-4 credits)
Restriction: Permission of instructor. Repeatable to 10 credits if content differs. Also offered as: ENTM609. Credit only granted for: ENTM609 or NRSC609.
A modular course with an interdisciplinary approach to the theory and practice of integrated pest management. Topics of modules, each 3-4 weeks long, vary each semester over a three year time frame, with the first module serving as a prerequisite for all other modules. See www.EntmClasses.umd.edu for description of modules.

NRSC 682 Methods of Plant Science Research (4 credits)
Credit only granted for: HORT682 or NRSC682. Formerly: HORT682.
The application of biochemical and biophysical methods to problems in biological research with emphasis on plant materials.

NRSC 689 Special Topics (1-3 credits)
Repeatable to 6 credits if content differs. Credit only granted for: HORT689 or NRSC689. Formerly: HORT689.
Credit according to time scheduled and organization of the course. Organized as a

lecture series on a specialized advanced topic.

NRSC 789 Advances in Research (1-4 credits)
Repeatable to 4 credits if content differs. Credit only granted for: AGRO789 or NRSC789.
A study of recent advances in agronomy research.

NRSC 798 Graduate Seminar (1 credits)
Repeatable to 6 credits. Credit only granted for: AGRO798, HORT798, or NRSC798.
First and second semester.

NRSC 799 Master's Thesis Research (1-6 credits)

NRSC 821 Advanced Methods of Soil Investigation (3 credits)
Restriction: Permission of AGNR-Plant Science & Landscape Architecture department; and permission of instructor.
First semester, alternate years. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry.

NRSC 831 Soil Mineralogy (4 credits)
Soil minerals, with emphasis on clay minerals, are studied from the viewpoint of soil genesis and physical chemistry. Mineralogical analyses by x-ray and chemical techniques.

NRSC 832 Advanced Soil Physics (3 credits)
An advanced study of physical properties of soils.

NRSC 898 Pre-Candidacy Research (1-8 credits)

Plant Biology (PBIO)

PBIO 689 Advanced Topics in Plant Biology (1-4 credits)
Prerequisite: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 16 credits if content differs. Formerly: BOTN689.
Lectures, experimental courses and other special instructions in various subjects in plant biology.

PBIO 698 Seminar in Plant Biology (1 credits)
Prerequisite: Permission of AGNR-Plant Science & Landscape Architecture department. Formerly: BOTN698.
Discussion of special topics and current literature in all phases of botany.

PBIO 699 Special Problems in Plant Biology (1-3 credits)
Formerly: BOTN699.
Credit according to time scheduled and organization of course. Maximum credit towards an advanced degree for the individual student at the discretion of the student's advisor. This course emphasizes research on a specialized advanced topic and may consist primarily of experimental procedures under the direction of visiting lecturers or resident faculty.

PBIO 710 Plant Membrance Physiology (2 credits)
Formerly: BOTN684.
Biochemical and biophysical approaches to plant membrane structure and function.

PBIO 727 Methods in Plant Tissue Culture (2 credits)
Prerequisite: Permission of AGNR-Plant Science & Landscape Architecture department. Formerly: BOTN620.
A methodology and techniques course designed to give the student background and experience in plant tissue culture.

PBIO 730 Techniques in Microscopy (4 credits)
Restriction: Permission of instructor. Formerly: BOTN656.
Preparation of biological materials for observation with the light microscope.

PBIO 740 Plant Population Biology (3 credits)
Restriction: Permission of instructor. Formerly: BOTN687.
An examination of current theoretical and empirical research covering topics such as demography, reproductive strategy, clonality, seed banks, interspecific competition and plant-herbivore interactions.

PBIO 799 Master's Thesis Research (1-6 credits)
Formerly: BOTN799.

PBIO 898 Pre-Candidacy Research (1-8 credits)

PBIO 899 Doctoral Dissertation Research (1-8 credits)
Formerly: BOTN899.

Persian (PERS)

PERS 401 Persian Composition (3 credits)
Prerequisite: PERS302; or permission of ARHU-School of Languages, Literatures, and Cultures department.
A genre approach to writing, focusing on how and why different texts are structured and written as they are. The purpose, context, and intended audience for written communication will guide the writing tasks conducted in and out of class. Students analyze and investigate a variety of purposes and audiences of particular relevance to Persian flagship students. Taught in Persian.

PERS 402 Persian Translation (3 credits)
Prerequisite: PERS302; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Focuses on hands-on practice of English/Persian and Persian/English translation as well as the problematic issues of translation. Taught in Persian.

PERS 405 Media and the Current Issues in Iranian Society (6 credits)
Prerequisite: PERS306; or equivalent as determined by FLPT (Foreign Language Placement Test).
Develops Persian language proficiency and domain-specific knowledge at advanced-mid to advanced-high level on ACTFL scale. Enhances linguistic and cultural competence. Provides a broad understanding of some of the current social, political and economic issues in modern Iran. Taught in Persian.

PERS 406 Practicum in Persian Translation (6 credits)
Prerequisite: PERS306; or equivalent as determined by the FLPT (Foreign Language Placement Test).
Provides opportunities for translation, interpretation, and analysis of various authentic oral and written texts (both English to Persian and Persian to English). Facilitates the development of Persian language proficiency at advanced level through a task-based approach that integrates all the language skills in pedagogical translation activities.

PERS 411 Readings in Iranian Islam (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
In-depth study of Iranian Islam via Islamic texts. Develops competency in speaking, reading, writing, and listening comprehension at advanced level. Taught in Persian.

PERS 441 Islam in Iran (3 credits)
Advent and development of Islamic culture in Iran. Taught in English.

PERS 452 Modern Persian Literature: A Survey (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Surveys development of poetry and prose in the Persian-speaking world in modern times. Periods and genres. Content varies. Mastery of Persian is required.

PERS 498 Special Topics in Persian Studies (3 credits)
Prerequisite: Permission of instructor. Repeatable to 9 credits if content differs.
Topic and language to be announced when offered.

PERS 601 Modern Persian Literature (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Selected readings in Persian poetry, fiction and drama covering topics related to contemporary Iranian society and culture. In Persian.

PERS 611 Practicum in Translation and Interpreting (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Analysis, translation, and interpreting of literary, expository, and oral texts, mainly from English to Persian. Focus on interdependence of language, context and culture. In Persian and English.

PERS 632 Film and Popular Culture in the Persian-speaking World (3 credits)
Restriction: Must be in M.Prof.Studies: Persian (Master's) program; or must be in the Graduate Certificate of Professional Studies-Persian. Additional information: Please visit http://www.oes.umd.edu/index.php?slab=persian-language for more information.
Study of socio-cultural, political and identity issues in the Persian-speaking world as seen through visual media, primarily film. In Persian.

PERS 641 Iranian Media and International Relations (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Political interests and diplomatic positions of Iran in the contemporary international context as reflected in its print and electronic media. In Persian.

PERS 642 Political Issues in Contemporary Iran (3 credits)
Restriction: Must be in M.Prof.Studies: Persian (Master's) program; or must be in the Graduate Certificate of Professional Studies-Persian. Additional information: Please visit http://www.oes.umd.edu/index.php?slab=persian-language for more information.
Analysis of current political context in Iran; impact of modernization and westernization. In Persian.

PERS 662 Persian Sociolinguistics (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Study of impact of social and regional factors on spoken and written usage. In Persian.

PERS 672 Persian Culture and Commerce (3 credits)
Restriction: Must be in M.Prof.Studies: Persian (Master's) program; or must be in the Graduate Certificate of Professional Studies-Persian. Additional information: Please visit http://www.oes.umd.edu/index.php?slab=persian-language for more information.
Major issues in Iranian business culture; relations between state and private sector; effects of globalization. In Persian.

PERS 689 Special Topics in Persian Studies (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 12 credits if content differs.
In-depth analysis of a particular aspect of Persian studies. In Persian.

Philosophy (PHIL)

PHIL 408 Topics in Contemporary Philosophy (3 credits)
Repeatable to 99 credits if content differs.
An intensive examination of contemporary problems and issues. Source material will be selected from recent books and articles.

PHIL 409 Advanced Studies in Contemporary Philosophy (1-6 credits)
Prerequisite: 6 credits in PHIL courses. Repeatable to 12 credits if content differs.
An in-depth study of a contemporary philosophical problem or issue. Topics will vary, but the course will encourage students to grapple with the primary literature in order to generate sustained critical analyses or proposed resolutions of issues under active consideration in contemporary philosophy.

PHIL 412 The Philosophy of Plato (3 credits)
Prerequisite: 9 credits in PHIL courses.
A critical study of selected dialogues.

PHIL 414 The Philosophy of Aristotle (3 credits)
Prerequisite: 3 courses in PHIL.
A critical study of selected portions of Aristotle's writings.

PHIL 416 Medieval Philosophy (3 credits)
Prerequisite: 6 credits in PHIL courses.
A study of philosophical thought from the fourth to the fourteenth centuries. Readings selected from Christian, Islamic, and Jewish thinkers.

PHIL 417 The Golden Age of Jewish Philosophy (3 credits)
Prerequisite: 3 credits in PHIL courses; or permission of ARHU-Philosophy department. Also offered as: JWST452. Credit only granted for: JWST452 or PHIL417.
Jewish philosophy from Maimonides in the 12th century to the expulsion of the Jews from Spain at the end of the 15th century. Topics include the limitations of human knowledge, creation of the world, foreknowledge and free will, and the existence of God.

PHIL 424 The Philosophy of Spinoza (3 credits)
Prerequisite: 3 credits in PHIL courses; or permission of ARHU-Philosophy department. Restriction: Must not have completed JWST453. Also offered as: JWST453. Credit only granted for: JWST453 or PHIL424.
An investigation of the metaphysical, ethical and political thought of the 17th century philosopher Benedict Spinoza.

PHIL 426 Twentieth Century Analytic Philosophy (3 credits)
Restriction: Permission of ARHU-Philosophy department; and senior standing. Credit only granted for: PHIL326 or PHIL426. Formerly: PHIL326.
Major issues in twentieth century analytic philosophy examined through such philosophers as Frege, Russell, Carnap, Moore and Wittgenstein.

PHIL 428 Topics in the History of Philosophy (3 credits)
Prerequisite: PHIL310 and PHIL320; or permission of ARHU-Philosophy department. Repeatable to 99 credits if content differs.

PHIL 431 Aesthetic Theory (3 credits)
Prerequisite: 9 credits in PHIL courses; or permission of ARHU-Philosophy department.
Study of the theory of the aesthetic as a mode of apprehending the world and of the theory of criticism, its conceptual tools and intellectual presuppositions.

PHIL 440 Contemporary Ethical Theory (3 credits)
Prerequisite: PHIL341; or permission of instructor.
Contemporary work on fundamental problems in ethical theory, such as whether there are moral truths, whether and how our moral claims can be justified, what exactly makes an act right or wrong, the nature of moral language, and the role of reason and emotion in moral judgment.

PHIL 445 Contemporary Political Philosophy (3 credits)
Restriction: Must have completed 3 credits in philosophy or political theory; or permission of ARHU-Philosophy department. And sophomore standing or higher.
Major trends in contemporary political philosophy: liberal, libertarian, communitarian, socialist, feminist.

PHIL 446 Law, Morality, and War (3 credits)
Prerequisite: GVPT401 and PHIL341; or permission of ARHU-Philosophy department. Also offered as: GVPT403.
An exploration of fundamental moral and legal issues concerning war.

PHIL 454 Philosophy of Space and Time (3 credits)
Prerequisite: 6 credits in PHIL courses.
A non-technical investigation of philosophical issues in the foundations of physics. Topics may include traditional philosophical problems of space and time, metaphysical issues about the nature of particles and fields, and philosophical problems associated with the introduction of probability into physics, such as the problem of irreversibility in thermodynamics and the problem of objectivity in quantum theory.

PHIL 456 Philosophy of Biology II (3 credits)
Prerequisite: PHIL256 or PHIL250; or must be Life Science major; or permission of ARHU-Philosophy department.
Questions about concepts, reasoning, explanation, etc., in biology, and their relations to those of other areas of science. Case studies of selected aspects of the history of biology, especially in the twentieth century.

PHIL 458 Topics in the Philosophy of Science (3 credits)
Repeatable to 6 credits if content differs.
A detailed examination of a particular topic or problem in philosophy of science.

PHIL 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

PHIL 470 Logical Theory (3 credits)
Prerequisite: PHIL370; or permission of instructor.
This course will treat a selection of the most important topics in modern logic: alternative proof-theoretic presentations of logical systems, completeness proofs for classical propositional and first-order logic, some basic computability theory, basic limitative results (such as Godel's incompleteness theorems), and some results concerning second-order logic. The primary focus of the course is a study of these fundamental topics, but we will also discuss some of the philosophical issues they raise.

PHIL 478 Topics in Philosophical Logic (3 credits)
Prerequisite: PHIL370; or permission of instructor. Recommended: PHIL470. Repeatable to 9 credits if content differs.
Methods and results of philosophical logic, the application of logical techniques to the study of concepts or problems of philosophical interest. Content will vary, either treating a particular logical area in detail--such as modal logic, conditional logic, deontic logic, intuitionistic or relevance logic, theories of truth and paradox--or surveying a number of these different areas.

PHIL 481 Philosophy of Psychology: Representation (3 credits)
Prerequisite: PHIL366 or PHIL280; and 6 credits in PHIL courses.
Semantics and representations within computational framework: intentionality, explicit vs. implicit representation, syntax vs. semantics of thought, connectionist approaches, images, classical vs. prototype theories of concepts.

PHIL 482 Philosophy of Psychology: Subjectivity (3 credits)
Prerequisite: PHIL366 or PHIL280; and 6 credits in PHIL courses.
The nature of subjectivity: problems of "point of view," the "qualities" or "feel" of things, emotions, consciousness - whether these phenomena can be captured by a computational theory of mind.

PHIL 484 Philosophy of Action (3 credits)
Reading in philosophy of action on topics such as: the nature and causes of action, practical reasons and rationality, self-control, weakness of will, freedom of action, free will, emotions and other sources of motivation.

PHIL 488 Topics in Philosophy of Cognitive Studies (3 credits)
Prerequisite: 3 credits in PHIL courses; or permission of ARHU-Philosophy department. Repeatable to 9 credits if content differs.
Examination of a particular topic or problem in philosophy of cognitive studies.

PHIL 489 Undergraduate Seminar in Philosophy (3-6 credits)
Restriction: Permission of ARHU-Philosophy department. Repeatable to 6 credits if content differs.
An intensive examination of a philosophical topic or topics.

PHIL 498 Topical Investigations (1-3 credits)

PHIL 640 Value Theory (3 credits)
A basic course in value theory for beginning graduate students, covering a number of topics in depth, to provide a springboard for further study and research in the area.

PHIL 651 Philosophy of Science (3 credits)
A basic course in philosophy of science for beginning graduate students, covering a number of topics in depth, to provide a springboard for further study and research in the area.

PHIL 660 Metaphysics, Mind, and Language (3 credits)
A basic course on selected issues in metaphysics, philosophy of mind, and philosophy of language for beginning graduate students, covering a number of topics in depth, to provide a springboard for further study and research in the area.

PHIL 670 Epistemology (3 credits)
A basic course in epistemology for beginning graduate students, covering a number of topics in depth, to provide a springboard for further study and research in the area.

PHIL 688 Selected Problems in Philosophy (1-3 credits)
Restriction: Permission of instructor.

PHIL 788 Research in Philosophy (1-6 credits)
Prerequisite: Permission of advisor or chair of tutorial-advisory committee required. Repeatable to 6 credits.

PHIL 798 Master's Level Independent Study (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.
Master's level independent study.

PHIL 799 Master's Thesis Research (1-6 credits)

PHIL 808 Seminar in the Problems of Philosophy (3 credits)
Restriction: Permission of instructor.

PHIL 828 Seminar in the History of Philosophy (3 credits)
Restriction: Permission of instructor.

PHIL 838 Seminar in Aesthetics (3 credits)
Restriction: Permission of instructor.

PHIL 848 Seminar in Ethics (3 credits)
Restriction: Permission of instructor.

PHIL 858 Seminar in Logic and Philosophy of Sciences (3 credits)
Restriction: Permission of instructor.

PHIL 859 Proseminar in the Philosophy of Science (3 credits)
Restriction: Permission of instructor. Repeatable to 9 credits if content differs.
Seminar on the core areas of research in philosophy of science, with the focus on a theme currently generating attention in the field.

PHIL 868 Seminar in Metaphysics (3 credits)
Restriction: Permission of instructor.

PHIL 869 Seminar in the Theory of Knowledge (3 credits)
Restriction: Permission of instructor.

PHIL 878 Seminar in Cognitive Studies (3-9 credits)
Restriction: Permission of ARHU-Philosophy department. Repeatable to 9 credits if content differs.
Methodology and research in various disciplines involved in cognitive studies.

PHIL 879 Seminar in Philosophy and Cognitive Studies (3 credits)
Repeatable to 9 credits if content differs.

PHIL 888 Professional Mentoring for Doctoral Students (1-3 credits)
Restriction: Permission of ARHU-Philosophy department. Repeatable to 3 credits if content differs.
Work with a faculty advisor on various aspects of professional development.

PHIL 889 Pedagogical Mentoring for Doctoral Students (1-3 credits)
Restriction: Permission of ARHU-Philosophy department. Repeatable to 3 credits if content differs.
Work with a faculty advisor to develop and improve pedagogical skills.

PHIL 898 Pre-Candidacy Research (1-8 credits)

PHIL 899 Doctoral Dissertation Research (1-8 credits)

Public Health Science (PHSC)

PHSC 401 History of Public Health (3 credits)
Restriction: Must be in Public Health Science program; and must have earned a minimum of 45 credits. Credit only granted for: PHSC401 or SPHL401. Formerly: SPHL401.
Emphasis is on the history of public health in the Western world from antiquity to the present. Also examines the influence of public health developments as they relate to the Western world as well as throughout diverse cultures and societies across the globe. Analysis focuses on the interaction among Western and non-Western cultures with respect to health issues, including science, policies, prevention and treatment.

PHSC 402 Public Health Emergency Preparedness (3 credits)
Prerequisite: Minimum grade of C- in EPIB300 and EPIB301. Restriction: Must be in Public Health Science program; and junior standing or higher. Credit only granted for: PHSC402 or SPHL402. Formerly: SPHL402.
Intensive introduction to public health emergency preparedness. Course will provide students with an overview of the role of public health in planning, prevention, preparedness, response, and recovery from disasters, both manmade and natural.

PHSC 410 Public Health Program Planning and Evaluation (3 credits)
Restriction: Must be in Public Health Science program; and junior standing or higher. Credit only granted for: PHSC410 or SPHL410. Formerly: SPHL410.
Students will become familiar with the dynamics of public health progra planning, and the basic process of identifying unmet needs. They will be able to identify different types of program evaluation, including needs assessment, formative research, process evaluation, impact assessment, and cost analysis.

PHSC 412 Food, Policy, and Public Health (3 credits)
Prerequisite: Must have completed HLSA300 with a C- or higher. Recommended: NFSC100. Restriction: Must be in Public Health Science program; and junior standing or higher. Credit only granted for: PHSC412 or SPHL412. Formerly: SPHL412.
Broad overview of the impact of food and food policy on public health. Course covers topics such as access to food, food systems, influence of food policies on the individual, the cost of food, influences on food selection, food safety risks and responses, nutrition-related health challenges, and a comparison of US food/nutrition issues with those of other nations.

PHSC 415 Essentials of Public Health Biology: The Cell, The Individual, and Disease (3 credits)
Prerequisite: Minimum grade of C- in BSCI202. Recommended: BSCI223. Restriction: Must be in Public Health Science program; and junior standing or higher. Credit only granted for: PHSC415, SPHL415 or SPHL498J. Formerly: SPHL415 and SPHL498J.
Presents the basic scientific and biomedical concepts of modern public health problems and explores in depth mechanisms and models of the major categories of disease. The biologic principles presented are foundations to public health disease prevention, control, or management programs.

PHSC 491 Public Health Science Internship (3 credits)
Restriction: Must be in Public Health Science program; and must have completed a minimum of 75 credits; and must have permission of instructor.

Credit only granted for: PHSC491 or SPHL491. Formerly: SPHL491. Additional information: Prospective students must meet with an advisor and complete internship verification, expectations and responsibilities prior to registration. This is generally completed the semester prior to beginning the internship.
The Public Health Science internship will enable students to gain practical experience under conditions conducive to academic, research and professional development. The internship is a time-limited, supervised period of public health professional experience carried out in a related professional organization or research setting.

Physics (PHYS)

PHYS 401 Quantum Physics I (4 credits)
Prerequisite: PHYS273. Corequisite: PHYS374 and MATH240. Formerly: PHYS421.
Introduces some quantum phenomena leading to wave-particle duality. Schroedinger theory for bound states and scattering in one dimension. One-particle Schroedinger equation and the hydrogen atom.

PHYS 402 Quantum Physics II (4 credits)
Prerequisite: PHYS401, PHYS374, and MATH240.
Quantum states as vectors; spin and spectroscopy, multiparticle systems, the periodic table, perturbation theory, band structure, etc.

PHYS 404 Introduction to Statistical Thermodynamics (3 credits)
Prerequisite: PHYS273; or students who have taken courses with comparable content may contact the department.
Introduction to basic concepts in thermodynamics and statistical mechanics.

PHYS 405 Advanced Experiments (3 credits)
Prerequisite: PHYS375. Restriction: Must be in a major within CMNS-Physics department.
Advanced laboratory techniques. Selected experiments from many fields of modern physics. Emphasis on self-study of the phenomena, data analysis, and presentation in report form.

PHYS 407 Undergraduate Experimental Research (3 credits)
Prerequisite: PHYS499 and PHYS375; and permission of CMNS-Physics department. Restriction: Must be in a major within CMNS-Physics department; and senior standing.
Students develop and complete an independent, experimental research project with a professor in the Physics Department. The project should be a continuation of work done in PHYS499A. To obtain permission, students must submit a proposal describing the experimental work to be completed and this proposal must be approved by their faculty mentor, the associate chair for undergraduate education and the chair of the laboratory committee. Students must maintain a lab notebook, give an oral presentation and complete a written report on their research that includes data and error analysis.

PHYS 410 Classical Mechanics (4 credits)
Prerequisite: PHYS374.
Theoretical foundations of mechanics with extensive application of the methods. Various mathematical tools of theoretical physics.

PHYS 411 Intermediate Electricity and Magnetism (4 credits)
Prerequisite: PHYS374.
Foundations of electromagnetic theory, with extensive applications of the methods. Thorough treatment of wave properties of solutions of Maxwell's equations.

PHYS 420 Principles of Modern Physics (3 credits)
Prerequisite: MATH246. And PHYS271 and PHYS270; or PHYS273.
A survey of atomic and nuclear phenomena and the main trends in modern physics. Appropriate for students in engineering and other physical sciences.

PHYS 428 Physics Capstone Research (2-4 credits)
Restriction: Must be in a major within CMNS-Physics department; and senior standing or higher; and permission of instructor. Repeatable to 4 credits.
Individual, focused research under the guidance of a faculty member. Discussion, presentations and, if appropriate, research group projects involved. Student must submit final research paper for completion of course. Paper may also serve as thesis required for High Honors in Physics. Not intended as a general "reading course" (see PHYS499).

PHYS 429 Atomic and Nuclear Physics Laboratory (3 credits)
Prerequisite: PHYS405.
Classical experiments in atomic physics and more sophisticated experiments in current techniques in nuclear physics.

PHYS 431 Properties of Matter (3 credits)
Prerequisite: PHYS271, PHYS270, and MATH241; and (PHYS401 or PHYS420). Also offered as: ENMA460. Credit only granted for: ENMA460 or PHYS431.
Introduction to solid state physics. Electromagnetic, thermal, and elastic properties of metals, semiconductors, insulators and superconductors.

PHYS 441 Topics in Nuclear and Particle Physics (3 credits)
Prerequisite: PHYS401 or PHYS402. Corequisite: PHYS402.
A survey of concepts in particle and nuclear physics, with a topical emphasis on the impact of the Weak Interaction and the discovery of Parity Violation.

PHYS 485 Electronic Circuits (4 credits)
Prerequisite: PHYS405. Corequisite: PHYS374. Restriction: Must be in a major within CMNS-Physics department.
Theory and application to experimental physics of modern semiconductor analog and digital circuits. Emphasis on understanding passive and active elements in practical circuits. Topics span the range from simple transistor circuits to microcomputers.

PHYS 499 Special Problems in Physics (1-16 credits)
Research or special study. Credit according to work done.

PHYS 521 General Physics for Science Teachers I (4 credits)
The first semester of a two-semester sequence in physics stressing physical insight for prospective secondary school science and mathematics teachers. Designed to integrate carefully lecture and laboratory and to serve as a model for persons planning to teach physics or physical science. Mathematics use will include algebra, trigonometry, with occasional references to calculus.

PHYS 522 General Physics for Science Teachers II (4 credits)
Prerequisite: PHYS521.
A continuation of PHYS 521.

PHYS 601 Theoretical Dynamics (3 credits)
Prerequisite: PHYS410; or students who have taken courses with comparable content may contact the department.
Lagrangian and Hamiltonian mechanics, two-body central force problem, rigid body motion, small oscillations, continuous systems.

PHYS 603 Methods of Statistical Physics (3 credits)
Credit only granted for: PHYS602 or PHYS603.
Foundations and applications of thermodynamics and statistical mechanics.

PHYS 604 Methods of Mathematical Physics (3 credits)
Prerequisite: Must have completed coursework in advanced calculus; and (PHYS411 and PHYS410). Or students who have taken courses with comparable content may contact the department.
Ordinary and partial differential equations of physics, boundary value problems, Fourier series, Green's functions, complex variables and contour integration.

PHYS 606 Electrodynamics (4 credits)
Prerequisite: PHYS604; or students who have taken courses with comparable content may contact the department.
Classical electromagnetic theory, electro- and magnetostatics, Maxwell equations, waves and radiation, special relativity.

PHYS 615 Nonlinear Dynamics of Extended Systems (3 credits)
Prerequisite: PHYS601.
Theory and applications of nonlinear dynamics of extended systems including nonlinear waves, pattern formation, turbulence, self-organized criticality and networks. Additional topics to be selected by instructor from areas of current research.

PHYS 621 Graduate Laboratory (3 credits)
Prerequisite: PHYS405; or students who have taken courses with comparable content may contact the department.
Design and performance of advanced experiments in modern and classical physics.

PHYS 622 Introduction to Quantum Mechanics I (4 credits)
Prerequisite: Must have an outstanding undergraduate background in physics.
First and second semesters. A study of the Schroedinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc. Applications to solid state, atomic, and nuclear physics.

PHYS 623 Introduction to Quantum Mechanics II (3 credits)
Prerequisite: Must have an outstanding undergraduate background in physics.
First and second semesters. A study of the Schroedinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory etc., and applications to solid state, atomic, and nuclear physics. Continuation of PHYS 622.

PHYS 624 Advanced Quantum Mechanics (3 credits)
Prerequisite: PHYS623.
Relativistic wave equations, second quantization in many body problems and relativistic wave equations, Feynman-Dyson perturbation theory, applications to many body problems, application to quantum electrodynamics, elements of renormalization.

PHYS 625 Non-relativistic Quantum Mechanics (3 credits)
Prerequisite: PHYS623.
Non-relativistic second quantization, single particle Green's function, perturbation theory, linked cluster expansion, Feynman and Goldstone diagrams; applications to imperfect Fermi gases; superconductivity.

PHYS 675 Introduction to Relativity, Gravitation and Cosmology (3 credits)
Prerequisite: PHYS606 and PHYS601.
Review of special relativity, followed by a study of the equivalence principle, curved spacetimes, and Einstein's equations. Selected applications to the solar system, stellar structure, black holes, gravitational waves, and cosmology.

PHYS 685 Research Electronics (4 credits)
Prerequisite: PHYS374 or PHYS405; or students who have taken courses with comparable content may contact the department. Restriction: Must not have completed PHYS485. Credit only granted for: PHYS485 or PHYS685.
An integrated lecture and laboratory course in electronics with equal emphasis on experimental methods and results and analysis using device models and up-to-date mathematical and numerical tools. Experiments and analysis of circuits with passive and single active devices form the background for the study of operational amplifiers, digital integrated circuits and systems, and microcomputers. The general topics of impedance matching, frequency response, feedback, interfacing and the extraction of signal from noise are stressed.

PHYS 704 Statistical Mechanics (3 credits)
Prerequisite: PHYS411.
A study of the determination of behavior of matter from microscopic models. Microcanonical, canonical, and grand canonical models. Applications of solid state physics and the study of gases.

PHYS 708 Seminar in Teaching College Physics (1 credits)

PHYS 709 Seminar in General Physics (1 credits)

PHYS 711 Symmetry Problems in Physics (3 credits)
Prerequisite: PHYS623.
A study of general methods of classification of physical systems by their symmetries and invariance properties, especially in quantum field theory applications.

PHYS 715 Chaotic Dynamics (3 credits)
Prerequisite: PHYS601.
Theory and applications of chaos in dynamical systems including such topics as strange attractors, Lyapanov exponents, quasiperiodicity, period doubling, intermittency, crises, fractal basin boundaries, chaotic scattering, KAM tori, and quantum chaos.

PHYS 718 Seminar in General Physics (1 credits)

PHYS 719 Seminar in General Physics (1 credits)

PHYS 721 Atomic and Optical Physics I (Survey) (3 credits)
Prerequisite: PHYS623.
A survey of topics involving the physics of atoms and their interaction with radiation, including atoms in external fields, lasers, atomic spectroscopy and atomic structure.

PHYS 726 Research Group Rotation in Quantum Optical Information (2 credits)
Prerequisite: Permission of CMNS-Physics department.
The purpose of this course is to familiarize students with the research groups carrying out research on quantum optical information in the Physics Department. Students spend the semester in two half-semester rotations, working with two different groups in the physics department that are actively involved with quantum information using optics. They should plan to be at the University at least three hours a week. At the end of each rotation they make a public presentation and prepare a web page with their results.

PHYS 728 Seminar in Atomic and Molecular Physics (1 credits)

PHYS 731 Solid State Physics: Survey (3 credits)
A variety of topics such as crystal structure, mechanical, thermal, electrical, and magnetic properties of solids, band

structure, the Fermi surface, and superconductivity will be treated. Although the emphasis will be on the phenomena, the methods of quantum mechanics are freely employed in this description.

PHYS 732 Introduction to Solid State Physics II (3 credits)
Prerequisite: PHYS731.
Second semester of survey course in condensed matter physics including topics in semiconductors, surface physics, magnetism and superconductivity.

PHYS 738 Seminar in Experimental Solid State Physics (1 credits)

PHYS 739 Seminar in Theoretical Solid State Physics (1 credits)

PHYS 741 Nuclear Physics: Survey (3 credits)
Prerequisite: PHYS623 and PHYS622.
An introductory survey of nuclear physics, including the following topics: properties of the two-nucleon force and the most popular phenomenological potentials; properties of nuclei including radii, shapes and charge distributions; introduction to nuclear structure models, including collective, independent particle, and shell model; basic features of radioactivity including weak interactions and alpha decay; introduction to nuclear reactions, including phenomenological optical potentials and distorted wave approximations.

PHYS 748 Seminar in Experimental Nuclear Physics (1 credits)

PHYS 749 Seminar in Theoretical Nuclear Physics (1 credits)

PHYS 751 Elementary Particle Physics I: Survey (3 credits)
Corequisite: PHYS624.
Nuclear forces are studied by examining interactions at high energies. Meson physics, scattering processes, and detailed analysis of high energy experiments.

PHYS 752 Elementary Particle Physics II: Theory (3 credits)
Prerequisite: PHYS751 and PHYS624.
Survey of elementary particles and their properties, quantum field theory, meson theory, weak interactions, possible extensions of elementary particle theory.

PHYS 758 Seminar in Elementary Particles and Quantum Field Theory (1 credits)

PHYS 759 Seminar in Elementary Particles and Quantum Field Theory (1 credits)

PHYS 761 Plasma Physics I: Survey (3 credits)
Prerequisite: PHYS606 and PHYS604.
A detailed study of plasma physics. The first semester treats particle orbit theory, magnetohydrodynamics, plasma waves, and transport phenomena.

PHYS 762 Plasma Physics II (3 credits)
Prerequisite: PHYS761.
Continuation of PHYS 761. Vlasov theory, including waves, stability, and weak turbulence, kinetic equation theories of correlations and radiative processes.

PHYS 769 Seminar in Plasma Physics (1 credits)

PHYS 776 Advanced Gravitation Theory (3 credits)
Prerequisite: PHYS623 and PHYS675.
Advanced topics in gravitation theory selected from Lagrangian and Hamiltonian formulations, geometric methods, symmetries of space times, black holes, singularity theorems, quantum effects in curved space, early universe, quantum gravity, and unified theories.

PHYS 778 Seminar in Space and Cosmic Ray Physics (1 credits)

PHYS 779 Seminar in General Relativity (1 credits)

PHYS 798 Special Problems in Advanced Physics (1-3 credits)
Projects or special study in advanced physics.

PHYS 799 Master's Thesis Research (1-6 credits)

PHYS 808 Special Topics in General Physics (1-4 credits)
Credit according to work done.

PHYS 809 Special Topics in General Physics (1-4 credits)
Credit according to work done.

PHYS 818 Special Topics in General Physics (1-4 credits)
Credit according to work done.

PHYS 819 Special Topics in General Physics (1-4 credits)
Credit according to work done.

PHYS 828 Special Topics in Atomic and Molecular Physics (1-4 credits)
Credit according to work done.

PHYS 829 Special Topics in Quantum Mechanics and Quantum Electronics (1-4 credits)
Credit according to work done.

PHYS 832 Theory of Solids I (3 credits)
Prerequisite: PHYS623. Corequisite: PHYS625.
Advanced topics in the quantum theory of solids from such fields as band structure calculations, optical properties, phonons, neutron scattering, the dynamics of electrons in one-band theory, the Landau Fermi Liquid Theory, charged Fermi liquids, the Fermi surface (surface impedance, cyclotron resonance, the DeHaas-Van Alphen Effect, etc.).

PHYS 838 Special Topics in Experimental Solid State Physics (1-4 credits)
Credit according to work done.

PHYS 839 Special Topics in Theoretical Solid State Physics (1-4 credits)
Credit according to work done.

PHYS 849 Special Topics in Theoretical Nuclear Physics (1-4 credits)
Credit according to work done.

PHYS 851 Advanced Quantum Field Theory (3 credits)
Prerequisite: PHYS624.
Renormalization, unitarity, gauge theory, S-matrix construction.

PHYS 858 Special Topics in Elementary Particles and Quantum Field Theory (1-4 credits)
Prerequisite: PHYS752 and PHYS851.
First semester.

PHYS 859 Special Topics in Elementary Particles and Quantum Field Theory (1-4 credits)
Credit according to work done.

PHYS 869 Special Topics in Plasma Physics (1-4 credits)
Credit according to work done.

PHYS 878 Special Topics in Space and Cosmic Ray Physics (1-4 credits)
Credit according to work done.

PHYS 879 Special Topics in General Relativity (1-4 credits)
Credit according to work done.

PHYS 888 Special Topics in Applied Physics (2 credits)

PHYS 889 Special Topics in Interdisciplinary Problems (1-4 credits)
Restriction: Permission of instructor.
Credit according to work done.

PHYS 898 Pre-Candidacy Research (1-8 credits)

PHYS 899 Doctoral Dissertation Research (1-8 credits)

Plant Sciences (PLSC)

PLSC 400 Environmental Plant Physiology (4 credits)
Prerequisite: PLSC100 or PLSC101; or (BSCI106 and BSCI105). Recommended: CHEM131 and CHEM132. Restriction: Junior standing or higher. Also offered as: ENST407. Credit only granted for: PLSC400 or ENST407.
An introduction to the basic physical and physiological principles necessary for understanding the interactions between plants and their environment. The overall objective is to understand plant responses and adaptions to the environment and the ecological relevance of these responses.

PLSC 401 Pest Management Strategies for Turfgrass (3 credits)
Prerequisite: PLSC305.
Interdisciplinary view of weed, disease, and insect management from an agronomy perspective. Plant responses to pest invasion, diagnosis of pest-related disorders, and principles of weed, disease and insect suppression through cultural, biological and chemical means are discussed.

PLSC 402 Sports Turf Management (3 credits)
Prerequisite: PLSC305 and PLSC401.
Sports turf management, including design, construction, soil modification, soil cultural techniques, pesticide use, fertilization, and specialized equipment.

PLSC 407 Advanced Crop Science (3 credits)
Prerequisite: PLSC101 and BSCI105.
A study of principles of production for forage crops, corn, small grains, rice, millets, sorghums, soybeans and other oil seed crops. Their seed production, processing, distribution and the current federal and state seed control programs for these agronomic crops will also be discussed.

PLSC 410 Commercial Turf Maintenance and Production (3 credits)
Prerequisite: PLSC305; or permission of AGNR-Plant Science & Landscape Architecture department.
Agronomic programs and practices used in hydroseeding, commercial lawn care, sod production and seed production. Current environmental, regulatory and business management issues confronting the turfgrass industry.

PLSC 415 Diseases of Trees and Shrubs (3 credits)
Prerequisite: PLSC100 and PLSC201; or permission of instructor. Credit only granted for: PLSC415 or PLSC489E. Formerly: PLSC489E.
Diseases on woody plants commonly planted or native to Mid-Atlantic region. Biology, identification and management of important plant pathogens.

PLSC 420 Principles of Plant Pathology (4 credits)
Prerequisite: CHEM131, CHEM132, and PLSC201; or students who have taken courses with comparable content may contact the department.
An introduction to the causal agents, nature and management of plant diseases with particular attention paid to economically important diseases of horticultural and agronomic crops.

PLSC 422 Biology of Fungi (3 credits)
Prerequisite: BSCI105; and BSCI106. Recommended: PLSC120; or PLSC420. Formerly: PLSC489O.
Providing an introduction to the diversity of fungi (mushrooms, molds and mildews), their biology, taxonomy, evolution, and impact on other organisms, such as plants, animals and humans. The course is for students interested in medical mycology, fungi associated to insects, fungi and their interactions with nature and other organisms, fungi in biotechnology, and fungi in agriculture, among many other topics of interest to biologists and agronomists. The course is an integration of lectures and laboratory exercises, as well as a few field trips.

PLSC 425 Green Roofs and Urban Sustainability (1 credits)
Credit only granted for: PLSC425 or PLSC489V. Formerly: PLSC489V.
The integration of disciplines associated with sustainability issues. Topics range from plant science to design to policy, all of which can contribute to improving the urban environment.

PLSC 430 Water and Nutrient Planning for the Nursery and Greenhouse Industry (3 credits)
Prerequisite: CHEM131 and CHEM132; or ENST200; or permission of instructor. Recommended: PLSC432.
Skills will be developed in order to write nutrient management plans for the greenhouse and nursery industry. Completion of this course can lead to professional certification in nutrient planning by the State of Maryland after MDA examinations are passed.

PLSC 432 Greenhouse Crop Production (3 credits)
Prerequisite: PLSC201 and PLSC202; and must have completed or be concurrently enrolled in BSCI442.
The commercial production and marketing of ornamental plant crops under greenhouse, plastic houses and out-of-door conditions.

PLSC 433 Technology of Fruit and Vegetable Production (4 credits)
Prerequisite: PLSC201, NRSC411, PLSC271, and PLSC202; or students who have taken courses with comparable content may contact the department. Corequisite: BSCI442. Recommended: ENST200. Restriction: Junior standing or higher. Credit only granted for: NRSC411 or PLSC433.
A critical analysis of research work and application of the principles of plant physiology, chemistry and botany to practical problems in the commercial production of fruit and vegetable crops.

PLSC 452 Environmental Horticulture (3 credits)
Prerequisite: PLSC100 or PLSC101; and (PLSC253 and PLSC254).
Environmental horticulture principles used in the establishment and maintenance of plant materials in residential and commercial landscapes will be addressed. The effect of soil conditions, environmental factors, and commercial practices will be discussed in relation to the growth and development of newly-installed plant materials. Field diagnostics will be used by students to assess significant problems of plant decline. Environmental sustainability will be combined with current commercial practices of storm water management, nutrient management, and irrigation

management to achieve an integrated approach to plant management.

PLSC 453 Weed Science (3 credits)

Weed identification, ecology, and control (cultural, mechanical, biological, and chemical methods).

PLSC 460 Application of Knowledge in Plant Sciences (3 credits)

Prerequisite: PLSC100 or PLSC101; or permission of instructor. Recommended: ENGL393 and ENST200; and (PLSC389 or PLSC399). Restriction: Senior standing or higher. And must be in a major within AGNR-Plant Science & Landscape Architecture department; or must be in another related major.

A capstone course based on interactions with plant science professionals and student-led class discussions. Students will apply their knowledge and experience to practical issues in the discipline, further develop critical thinking ability, and enhance their communication, teamwork, and professional skills. Topics will include nutrient management, integrated pest management, plant interactions with urban and rural ecosystems, planning of public grounds, plant biotechnology, and teaching skills.

PLSC 461 Cultural Management of Nursery and Greenhouse Systems: Substrates (1 credits)

Credit only granted for: PLSC461 or PLSC489T. Formerly: PLSC489T. Additional information: Course material is delivered primarily online, but a four hour face-to-face lecture/lab will be held at the end of the module. PLSC 461, 462 and 464 will be taught sequentially during the semester.

One of three 1-credit modules (PLSC461, PLSC462 and PLSC 464)covering the management techniques used in the intensive culture of plants in commercial operations. Specifically, this module covers the composition, handling, physical and chemical properties of substrates and how they should be managed to maximize plant growth.

PLSC 462 Cultural Management of Nursery and Greenhouse Systems; Irrigation (1 credits)

Credit only granted for: PLSC462 or PLSC489W. Formerly: PLSC489W. Additional information: Course material is delivered primarily online, but a four hour face-to-face lecture/lab will be held at the end of the module. PLSC 461, 462 and 464 will be taught sequentially during the semester.

One of three 1-credit modules (PLSC461, PLSC462 and PLSC464) covering the management techniques used in the intensive culture of plants in commercial operations. Specifically, this module covers water quantity and quality issues, water supply (basic hydraulics), irrigation system design and irrigation system evaluation (performance) to maximize water application efficiency.

PLSC 463 Cultural Management of Nursery and Greenhouse Systems: Surface Water (1 credits)

Credit only granted for: PLSC463 or PLSC489Y. Formerly: PLSC489Y.

One of four 1-credit modules covering the management techniques used in the intensive culture of plants in commercial operations. Specifically, this module covers the basics of surface water management, specific management practices, containment basin design and capture and recycling of irrigation water for intensive plant production operations. Course material is delivered primarily online, but a four hour face-to-face lecture/lab will be held at the end of the module.

PLSC 464 Cultural Management of Nursery and Greenhouse Systems: Nutrients (1 credits)

Credit only granted for: PLSC464 or PLSC489Z. Formerly: PLSC489Z. Additional information: Course material is delivered primarily online, but a four hour face-to-face lecture/lab will be held at the end of the module. PLSC 461, 462 and 464 will be taught sequentially during the semester.

One of three 1-credit modules (PLSC461, PLSC462 and PLSC464) covering the management techniques used in the intensive culture of plants in commercial operations. Specifically, this module covers the basics of fertilization, different fertilization strategies and nutrient use and efficiency, to optimize nutrient application practices in intensive plant production systems.

PLSC 471 Forest Ecology (3 credits)

Prerequisite: PLSC201 or BSCI106.

An understanding of the forest ecosystem, its structure and the processes that regulate it are provided. It also considers changes that occur in forests, the interaction of environment and genetics in promoting ecosystem sustainability, and the role of human influences on urban forest ecosystems.

PLSC 472 Capstone-Urban Forest Project Management (3 credits)

Prerequisite: ENST200, PLSC272, and PLSC471. Restriction: Senior standing or higher; and must be in a major within AGNR-Plant Science & Landscape Architecture department.

Students will synthesize the ideas and information learned from their studies in urban forestry. Working in teams, students will complete projects involving real-world issues. Student projects will use scientific, social, political and ethical considerations in an interdisciplinary approach to provide solutions to their problem.

PLSC 473 Woody Plant Physiology (3 credits)

Prerequisite: BSCI442 or PLSC201; or students who have taken courses with comparable content may contact the department.

Concentration is placed on physiological processes important to woody plant growth and development. Emphasis will be placed on current concepts and theories of how woody plants grow and develop, and the critical assessment of current research in woody plant physiology. Course readings will include textbook assignments and selected papers from the current scientific literature.

PLSC 474 Physiology of Maturation and Storage of Horticultural Crops (3 credits)

Prerequisite: Must have completed or be concurrently enrolled in BSCI442.

The physiological and biochemical changes occurring during storage of horticultural commodities. Application of scientific principles to handling and storage of fresh produce.

PLSC 475 Applied Forestry Practices (3 credits)

Prerequisite: ENST200. And ENST360; or PLSC471. Also offered as: ENST406. Credit only granted for: ENST406 or PLSC475.

Focuses on the applied dynamics of a set of forest practices such as management, silviculture, measurement and inventory, preparation of a management plan, etc, within the urban/rural interface. Several field trips are included to gain hands-on experience.

PLSC 481 Vegetation Assessment and Analysis (2 credits)

Prerequisite: PLSC100 or BSCI106; or permission of instructor. Recommended: PLSC201, BSCI360, PLSC226, or PLSC471.

An overview of vegetation assessment through the collection of data in the field (e.g. plots and transects) and the analysis of existing data and remotely detected images (e.g. Aerial photographs and GIS layers).

PLSC 489 Special Topics in Plant Science (1-3 credits)

Repeatable to 6 credits if content differs.

A lecture and or laboratory series organized to study a selected phase of Plant Science not covered by existing courses. Credit according to time scheduled and organization of the course.

PLSC 601 Plant Genomics (3 credits)
Credit only granted for: AGRO601, NRSC601, or PLSC601. Formerly: NRSC601.
An advanced course in plant genomics which is the study of genes of plant chromosomes. It will cover current topics in gene mapping, molecular markers, QTLs, gene sequencing, and genetic engineering with special focus on agriculturally important traits.

PLSC 602 Advanced Crop Breeding II (2 credits)
Prerequisite: PLSC601; and must have completed a graduate statistics course.
Quantitative inheritance in plant breeding including genetic constitution of a population, continuous variation, estimation of genetic variances, heterosis and inbreeding, heritability, and population movement.

PLSC 608 Research Methods (2 credits)
Prerequisite: Permission of AGNR-Plant Science & Landscape Architecture department. Repeatable to 6 credits if content differs. Credit only granted for: AGRO608, NRSC608, or PLSC608. Formerly: NRSC608.
An overview of research methods and applications related to plant sciences. Topics covered include current research advances, professional conduct and ethics, and preparation of grant proposals, manuscripts, and scientific presentations.

PLSC 609 Integrated Pest Management (1-4 credits)
Restriction: Permission of instructor. Repeatable to 10 credits if content differs. Also offered as: ENTM609. Credit only granted for: ENTM609, NRSC609, or PLSC609. Formerly: NRSC609.
A modular course with an interdisciplinary approach to the theory and practice of integrated pest management. Topics of modules, each 3-4 weeks long, vary each semester over a three year time frame, with the first module serving as a prerequisite for all other modules. See www.EntmClasses.umd.edu for description of modules.

PLSC 618 Advances in Research; Critiquing Primary Plant Science Literature (1 credits)
Repeatable to 7 credits.
Discussion of advances in plant science research based on classic and current scientific literature.

PLSC 619 Seminars in Plant Science and Landscape Architecture (1 credits)
Repeatable to 7 credits if content differs.
Enhancement of student learning and enrichment of student curriculum for the Plant Science Graduate Program through a combination of research seminar attendance and post-seminar discussion. Research seminars will be given by prominent scientists in the field of plant sciences and post-seminar discussions will be facilitated by the instructor along with student discussion leaders.

PLSC 682 Methods of Plant Science Research (4 credits)
Credit only granted for: HORT682, NRSC682, or PLSC682. Formerly: NRSC682.
The application of biochemical and biophysical methods to problems in biological research with emphasis on plant materials.

PLSC 685 Advanced Plant Ecophysiology (3 credits)
Prerequisite: Must have completed one course in plant physiology. Credit only granted for: NRSC685 or PLSC685. Formerly: NRSC685.
Growth, productivity and survival are intimately linded to a plant's ability to adjust to its environment. The information provided in this course is designed to provide an introduction to the basic physical and psysiological principles necessary for understanding the interactions between plants and their environment. The overall objective of this course is to understand plant responses and adaptations to the environment and the ecological relevance of these responses.

PLSC 689 Special Topics (1-3 credits)
Repeatable to 6 credits if content differs. Credit only granted for: HORT689, NRSC689, or PLSC689. Formerly: NRSC689.
Credit according to time scheduled and organization of the course. Organized as a lecture series on a specialized advanced topic.

PLSC 782 Physiology, Biochemical and Molecular Biology of Herbicides and Plant Growth Regulators (3 credits)
Prerequisite: BSCI442. Credit only granted for: NRSC782 or PLSC782. Formerly: NRSC782.
In this class we will study natural and synthetic chemicals which regulate the growth and development of plants. The mechanism by which herbicides and plant growth regulators express their activity on plants and the impact of these chemicals on the environment will be a primary focus of this course. The interaction of these chemicals with biotechnology advances will also be examined.

PLSC 785 Advanced Post-Harvest Physiology (3 credits)
Prerequisite: PLSC474 and BCHM461; or permission of AGNR-Plant Science & Landscape Architecture department. Credit only granted for: NRSC785 or PLSC785. Formerly: NRSC785.
Physiological, biochemical and molecular aspects of senescence of detached plant organs, such as fruits, leaves and flowers.

PLSC 789 Advances in Research (1 credits)
Repeatable to 7 credits if content differs. Credit only granted for: AGRO789, NRSC789, or PLSC789. Formerly: NRSC789.
Discussion of advances in plant science research based on classic and current scientific literature.

PLSC 798 Graduate Seminar (1 credits)
Repeatable to 6 credits if content differs. Credit only granted for: AGRO798, HORT798, NRSC798, or PLSC798. Formerly: NRSC798.
First and second semester.

PLSC 799 Master's Thesis Research (1-6 credits)

PLSC 802 Epidemiology and Plant Disease Mangement (3 credits)
Credit only granted for: AGRO802, NRSC802, or PLSC802. Formerly: NRSC802.
An in-depth advanced course for graduate students in plant pathology, agronomy, entomology and horticulture emphasizing the principles of effective plant disease management in the agroecosystem.

PLSC 805 Advanced Crop Physiology (2 credits)
Prerequisite: BSCI442; and must have completed advanced training in plant sciences. Credit only granted for: NRSC805 or PLSC805. Formerly: NRSC805.
Major emphasis will be on physiological processes affecting yield and productivity of major food fiber and industrial crops of the world. Topics such as photosynthesis, respiration, photorespiration, nitrogen metabolism will be related to crop growth as affected by management decisions. Topics of discussion will also include growth analysis and the use of computer modeling of crop growth by plant scientists.

PLSC 898 Pre-Candidacy Research (1-8 credits)

PLSC 899 Doctoral Dissertation Research (1-8 credits)

Portuguese (PORT)

PORT 405 Portuguese for Spanish Speakers (3 credits)
Restriction: Must have native or acquired fluency in Spanish.
Intensive basic grammar, reading and auditory comprehension. Native or acquired fluency in Spanish required.

PORT 408 Special Topics in Portuguese Literature (3 credits)
Repeatable to 6 credits if content differs.
Major themes and literary developments from the late 18th century to the present.

PORT 409 Special Topics in Brazilian Literature (3-6 credits)
Major themes and literary development from the late eighteenth century to the present. Specific topic to be announced each time the course is offered.

PORT 478 Themes and Movements of Luso-Brazilian Literature in Translation (3 credits)
Repeatable to 6 credits if content differs.
A study of specific themes and movements either in Portuguese or Brazilian literature, as announced. Designed for students for whom the literatures would be inaccessible in Portuguese.

PORT 480 Machado de Assis (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department.
Fiction of Machado de Assis covering his romantic and realistic periods.

PORT 609 Special Topics - Brazilian Literature (3-6 credits)
Prerequisite: Must have reading knowledge of Portuguese - fluency in Spanish or Portuguese. Repeatable to 6 credits if content differs.
Representative topics/authors/works of Brazilian literature. Texts in Portuguese: classes conducted in Portuguese and Spanish.

PORT 699 Independent Study of Portuguese (1-3 credits)
Repeatable to 3 credits.
This course is designed to provide graduate students an opportunity to pursue independent study under the supervision of a member of the department.

Psychology (PSYC)

PSYC 401 Biological Bases of Behavior Laboratory (4 credits)
Prerequisite: PSYC300; and (PSYC301 or BSCI353). Restriction: Permission of instructor; and must be in Psychology program; and must have earned a minimum of 85 credits.
A laboratory course to introduce students to some of the basic physiological and anatomical techniques of contemporary neuroscience. Exercises look at specific neurons or groups of neurons and how they control such simple behaviors as swimming, prey capture, and species recognition. The lab exercises use living invertebrates and cold-blooded vertebrates.

PSYC 402 Neural Systems and Behavior (3 credits)
Prerequisite: PSYC301. Additional information: Priority is given to PSYC majors.
Research on the physiological basis of behavior, including considerations of sensory phenomenon, motor coordination, emotion, drives, and the neurological basis of memory.

PSYC 403 Animal Behavior (3 credits)
Prerequisite: PSYC301.
Reviews the theoretical framework underlying the study of animal behavior. The genetic, hormonal and physiological basis of behavior, and the relation to ecological and evolutionary processes will be discussed using examples that range from invertebrate animals to humans.

PSYC 404 Introduction to Behavioral Pharmacology (3 credits)
Prerequisite: PSYC301. Restriction: Must be in Psychology program.
Theoretical viewpoints on the interaction of drugs and behavior. Basic principles of pharmacology, the effects of drugs on various behaviors, experimental analysis of drug dependence and abuse, and neuropharmacology and behavior.

PSYC 406 Neuroethology (3 credits)
Prerequisite: PSYC301. Restriction: Must be in Psychology program.
A merger between the disciplines of neuroscience and ethology (animal behavior) studies the behavioral functions of nervous systems using a comparative and evolutionary approach. Students will learn how the nervous system controls behavioral patterns in a variety of different organisms ranging from insects to mammals.

PSYC 407 Behavioral Neurobiology Laboratory (4 credits)
Prerequisite: PSYC300 and PSYC301. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits.
Laboratory exercises introducing concepts and techniques of behavioral neurobiology. Activities emphasize design of neurobiology experiments, hands-on experience with behavioral and neurobiological techniques, data collection, and analysis of the results. Most exercises use living animals.

PSYC 409 Topics in Neurosciences Seminar (1 credits)
Restriction: Permission of BSOS-Psychology department; and junior standing or higher. Repeatable to 4 credits if content differs.
Current research in neurosciences will be presented, read, and discussed. Emphasis will change each term.

PSYC 410 Experimental Psychology: Sensory Processes I (4 credits)
Prerequisite: PSYC300. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits; and permission of BSOS-Psychology department.
A systematic survey of the content, models, and methodology of sensory and perceptual research.

PSYC 411 Introduction to Functional Magnetic Resonance Imaging (3 credits)
Prerequisite: PSYC200, PSYC301, and PSYC300. Restriction: Must be in a major within BSOS-Psychology department. Credit only granted for: PSYC309N or PSYC411. Formerly: PSYC309N.
An introduction to functional magnetic resonance imaging (fMRI). Students will be taught about formulating testable hypotheses with fMRI, utilizing basic methods in fMRI studies, and understanding existing limitations of fMRI studies in the literature.

PSYC 413 Developmental Cognitive/Social Neuroscience (3 credits)
Prerequisite: PSYC355 or PSYC301; or permission of instructor. Restriction: Restricted to psychology majors and neuroscience minors during the registration period. All other students can reserve a position on the hold file, and will be offered a seat on a space-available basis. Credit only granted for: PSYC309D, PSYC309H, or PSYC413. Formerly: PSYC309D, PSYC309H.
Developmental cognitive/social neuroscience is the study of how the brain underlies the acquisition, refinement, and maintenance of complex cognitive and social abilities. The goal of this course is to gain an understanding of current research, methods, and theories in developmental cognitive/social

neuroscience through lecture and discussion.

PSYC 414 Science of Sleep and Biological Rhythms (3 credits)
Prerequisite: PSYC100 and PSYC301; or permission of instructor. Restriction: Must be in a major within the BSOS-Psychology department; and restricted to psychology majors during the registration period. All other majors will be placed on a hold file.
A study of the behavioral neurobiology of biological rhythms and sleep including behavioral and social contexts relevant to chronobiology and sleep science. Current scientific research on the role of the central nervous system will be a major focus.

PSYC 415 History of Psychology (3 credits)
Prerequisite: PSYC100.
Origins of psychology in philosophy and biology, and the development of psychology as a science in the nineteenth and twentieth centuries. Consideration of current theoretical perspectives and experiments in relation to the enduring problems of psychology, and of the role of culture, science, and technology in the development of psychological ideas.

PSYC 416 Development of Attachment in Infancy and Childhood: Theory, Research, Methods, and Clinical Implications (3 credits)
Prerequisite: PSYC355; or permission of instructor. Restriction: Must be in a major within the BSOS-Psychology department. Credit only granted for: PSYC309J or PSYC416. Formerly: PSYC309J.
Overview of the development of attachment during infancy and childhood, examining theory, research methods, research findings, and clinical implications. Students will observe videos of attachment assessments, lead class discussion of readings, make class presentations, and complete writing assignments.

PSYC 420 Experimental Psychology: Social Psychology Laboratory (4 credits)
Prerequisite: PSYC300 and PSYC221. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits.
A laboratory course to provide a basic understanding of experimental method in social psychology and experience in conducting research on social processes.

PSYC 423 Advanced Social Psychology (3 credits)
Prerequisite: PSYC420.
A systematic review of research and points of view in regard to major problems in the field of social psychology.

PSYC 424 Communication and Persuasion (3 credits)
Prerequisite: PSYC221 and PSYC200.
Effect of social communication upon behavior and attitudes. Theory and research concerning attitude change and social influence.

PSYC 425 Psychology and Law (3 credits)
Prerequisite: PSYC100, PSYC200, and PSYC300. Restriction: Must be in Psychology program. Credit only granted for: PSYC309K, PSYC325, or PSYC425. Formerly: PSYC309K.
An introduction to the intersection of psychology and the criminal justice sytem, known as the field of legal psychology. The material covered will span the course of the criminal justice process and examine each aspect from a psychological perspective beginning with profiling and moving on to eyewitness memory and judgements through perpetrator memories and interrogation techniques. These apsects will be evaluated with a research lens as well as an applied outlook.

PSYC 432 Counseling Psychology: Theories, Research, and Practice (3 credits)
Prerequisite: PSYC200.
Analysis of research and intervention strategies developed and used by counseling psychologists. Historical and current trends in content and methodology.

PSYC 433 Basic Helping Skills: Research and Practice (4 credits)
Prerequisite: PSYC300; and (PSYC434, PSYC334, PSYC353, PSYC435, PSYC436, or PSYC432). Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits.
Theories and research regarding effective helping skills. Students will practice helping skills with each other and will conduct research projects evaluating their helping skills. Students should be willing to talk about personal issues in class. Because of the participatory nature of this class, attendance normally will be included in the computation of grades.

PSYC 434 Severe Mental Disorders: Etiology and Treatment (3 credits)
Prerequisite: PSYC300, PSYC353, and PSYC301. Restriction: Must be in Psychology program.
Examines multiple perspectives on severe mental illnesses such as schizophrenia and the major affective disorders. Integrates the biological findings with the human experience of these illnesses, their cultural and socio-political aspects, and their psychological, pharmacological, and social service treatments.

PSYC 435 Theories of Personality and Psychotherapy (3 credits)
Prerequisite: PSYC200.
Major theories of personality and research methods and findings relevant to those theories.

PSYC 436 Introduction to Clinical Psychology: From Science to Practice (3 credits)
Prerequisite: PSYC300.
Critical analysis of clinical psychology, with particular emphasis on current developments and trends.

PSYC 437 The Assessment and Treatment of Addictive Behaviors (3 credits)
Prerequisite: PSYC100; and 9 credits in PSYC courses. Credit only granted for: PSYC309E (taken in the Winter Term) or PSCY437. Formerly: PSYC309E.
Explores the current research in assessment and treatment of addictive behaviors. Topics may include addictions in the areas of alcohol, drugs, nicotine, gambling, and eating.

PSYC 438 Special Topics in Study Abroad IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

PSYC 440 Experimental Psychology: Cognitive Processes (4 credits)
Prerequisite: PSYC341 and PSYC300. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits.
A survey of the content, models, and methods in cognitive psychology with an emphasis on auditory and visual pattern recognition, information processing, attention, memory, learning, problem solving, and language.

PSYC 442 Psychology of Language (3 credits)
Prerequisite: PSYC300 and PSYC341. Restriction: Must be in Psychology program.
Introductory survey of the psychology of language, focusing on the cognitive processes that enable us to produce and understand language. Topics include speech perception, speech production, syntactic processing, language development, language disorders, and the brain bases of language.

PSYC 443 Thinking and Problem Solving (3 credits)
Prerequisite: PSYC341 and PSYC300. Restriction: Must be in Psychology program.
Historical development, current theory and data, and research methods in problem solving. Formal problem solving theory and computer models of thinking and human problem-solving behavior. The uses of strategies to improve students' own thinking processes and problem-solving behavior.

PSYC 444 Cyberpsychology: The Psychology of Human/Computer Interactions (3 credits)
Prerequisite: PSYC200. Credit only granted for: PSYC309E or PSYC444. Formerly: PSYC309E.
Explores traditional psychological processes in the rapidly changing world of computer and internet technologies. Students will address how the use of computers impacts many of the major topics in psychology.

PSYC 445 The Psychology of Video Games and Entertainment (3 credits)
Prerequisite: PSYC200. Restriction: Must be in Psychology program; or permission of BSOS-Psychology department. Credit only granted for: PSYC309V or PSYC445. Formerly: PSYC309V.
An exploration of the diverse elements and theories in the psychology of video games and entertainment. The history and taxonomy of video games, cognitive and affective elements, virtual reality and social presence, video game violence, and educational and ethical issues will be covered.

PSYC 450 Field Research in Organizational Psychology (4 credits)
Prerequisite: PSYC300 and PSYC361. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits.
Methods of field research applicable to organizational settings are examined, including field experiments and quasi-experiments, observation, interviewing, surveys, content analysis, and various forms of qualitative inquiry.

PSYC 455 Cognitive Development (3 credits)
Prerequisite: PSYC300. Restriction: Must be in Psychology program.
Theory and research in cognition from a life-span developmental perspective including memory, reasoning, attention, spatial cognition, and conceptual organization, and discussions of implications of current research for a variety of educational interventions.

PSYC 456 Research Methods in Developmental Psychology Laboratory (4 credits)
Prerequisite: PSYC300; and permission of BSOS-Psychology department. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits.
A presentation of major research designs used in developmental psychology and of the methodology used in developmental research, such as observational research, program evaluation, and laboratory experimentation.

PSYC 457 Consensual Qualitative Research Methods Laboratory (4 credits)
Prerequisite: PSYC200 and PSYC300; and permission of BSOS-Psychology department. Restriction: Must be in Psychology program; and must have earned a minimum of 85 credits. Credit only granted for: PSYC457 or PSYC498H (taken in Fall 2010 or Fall 2011). Formerly: PSYC498H.
An exploration of philosophy of science and methods involved in qualitative research methods in counseling psychology, along with a comparison to quantitative research methods. The laboratory component involves conducting a qualitative study, including reviewing the literature, designing an interview protocol, training to conduct interviews, conducting interviews, analyzing the data, and writing a manuscript.

PSYC 458 Applied Developmental Psychology (3 credits)
Prerequisite: PSYC200; and (PSYC356, PSYC355, or PSYC357). Repeatable to 6 credits if content differs.
An examination of a topic in developmental psychology which has been examined in the laboratory and is central to developmental theories. Extension of these analyses to practical and social issues in the daily life of the developing individual. Topics will vary from semester to semester.

PSYC 460 Psychological Foundations of Personnel Selection and Training (3 credits)
Prerequisite: PSYC361 and PSYC200.
An examination of issues and processes involved in the design and evaluation of personnel selection and training programs in a variety of organizational settings: job, person and organizational analysis; organizational choice; development of predictors; evaluation of instructional and training systems; criteria for performance evaluation, promotion and training.

PSYC 463 Psychology of Motivation and Attitudes in Organizational Settings (3 credits)
Prerequisite: PSYC361 and PSYC200.
Theories, research and practice regarding the assessment, understanding, and prediction of motivation at work. Theories, assessment and consequences of various work-related attitudes. An integration of theory, research, and practice.

PSYC 464 Psychology of Leaders in Work Organizations (3 credits)
Prerequisite: PSYC200 and PSYC361.
The psychological assumptions and implications of various theories of management and leadership. Selections and training; development of careers; influence processes; change of managerial behavior; and the impact of the larger environment, nature of product or service, and organization structure on managerial behavior.

PSYC 465 Psychology of Organizational Processes (3 credits)
Prerequisite: PSYC361 and PSYC200.
Theories of interpersonal, intra- and inter-group relations, with emphasis on issues of conflict, competition, cooperation and the role of power in organizations. Organizational diagnosis and intervention.

PSYC 468 Field Experience and Special Assignments in Honors (1-3 credits)
Prerequisite: Must have permission of supervisor and honors faculty. Restriction: Permission of BSOS-Psychology department. Repeatable to 6 credits.
An individual experience arranged by the honors student and his or her supervisor. A proposal submitted to the honors faculty in the semester preceding registration for the course should state the activities anticipated and the method of evaluation.

PSYC 469 Honors Thesis Proposal Preparation (3 credits)
Restriction: Permission of BSOS-Psychology department. Repeatable to 3 credits.
Development of honors thesis proposal by preliminary research and literature review. Presentation of formal proposal to the thesis committee.

PSYC 478 Independent Study in Psychology (1-3 credits)
Restriction: Permission of BSOS-Psychology department; and must have earned a minimum of 9 credits in Psychology; and must have earned a minimum GPA of 3.0 in Psychology; and minimum cumulative GPA of 2.8. Repeatable to 9 credits.

PSYC 479 Special Research Problems in Psychology (1-3

credits)
Restriction: Permission of BSOS-Psychology department; and must have earned a minimum of 9 credits in Psychology; and must have earned a minimum GPA of 3.0 in Psychology; and minimum cumulative GPA of 2.8. Repeatable to 9 credits.

PSYC 488 Advanced Psychology I (Honors) (3 credits)
Prerequisite: PSYC200. Restriction: Permission of BSOS-Psychology department.
Seminar covering topics in sensation, perception, learning, and motivation.

PSYC 489 Advanced Special Topics in Psychology (3 credits)
Prerequisite: PSYC300. Repeatable to 9 credits if content differs.
Treatment of a specialized topic in psychology.

PSYC 498 Advanced Psychology II (Honors) (3 credits)
Prerequisite: PSYC488; or permission of BSOS-Psychology department.
Seminar covering topics in measurement, social processes, developmental processes and other subject matter of current interest.

PSYC 499 Honors Thesis Research (3 credits)
Prerequisite: PSYC469; and must have permission of thesis advisor.

PSYC 601 Quantitative Methods I (4 credits)
Prerequisite: PSYC200; or students who have taken courses with comparable content may contact the department.
A basic course in quantitative/mathematical analysis and statistical methods in psychology with an emphasis on conceptual understanding. Topics include issues in measurement, probability theory, statistical inference and hypothesis testing, parameter estimation, bivariate regression, and correlation.

PSYC 602 Quantitative Methods II (4 credits)
Prerequisite: PSYC601.
A continuation of PSYC 601. Topics include experimental design, analysis of variance, analysis of covariance, multiple regression, and general linear models.

PSYC 603 Introduction to Industrial and Organizational Psychology (3 credits)
Credit only granted for: PSYC603 or PSYC730. Formerly: PSYC730.
Advanced survey of industrial-organizational psychology, including selection, training, motivation, group processes, leadership, organizational psychology, and organizational theory. Readings stressed and seminar time will be used for lectures, discussion and integration of the reading materials.

PSYC 604 Fundamentals of Social Psychology (3 credits)
Credit only granted for: PSYC604 or PSYC640. Formerly: PSYC640.
A survey of classic and contemporary theories, research and methods in social psychology.

PSYC 606 Human Biopsychology (3 credits)
Credit only granted for: PSYC606 or PSYC660. Formerly: PSYC660.
An introductory graduate level course in human psychobiology designed for graduate students with little specific training in this area. Introduction to the comparative and evolutionary approach to the study of human behavior, the biobehavioral basis of human sexuality and social behavior, the physiological basis of higher cortical functions in humans including language, memory, and spatial perception, and an introduction to neuropharmacology.

PSYC 607 Advanced Topics in Human-Learning and Cognitive Psychology (3 credits)
Credit only granted for: PSYC607 or PSYC671. Formerly: PSYC671.
A systemic review of major topic areas in the field of human learning and cognition, with emphases on information processes, mental representations, memory, reasoning, problem solving, and language.

PSYC 610 Historical Viewpoints and Current Theories in Psychology (3 credits)
Credit only granted for: PSYC610 or PSYC688. Formerly: PSYC688.
Origins of psychology in philosophy and the sciences; the development of psychology as a science in the nineteenth and twentieth centuries. A review of current theoretical perspectives and research in relation to the enduring issues in psychology. The role of culture, science, and technology in the development of psychological ideas.

PSYC 611 Advanced Developmental Psychology (3 credits)
Systematic exploration of contemporary and classic theories of development focusing on the assumptions they make and research they generate.

PSYC 612 Theories of Personality (3 credits)
Scientific requirements for a personality theory. Postulates and relevant research literature for several current personality theories.

PSYC 619 Research Team in Clinical Psychology (1-3 credits)
Repeatable to 6 credits.
Participation in ongoing faculty-student research teams focusing on discussion of research topics, presentation and critique of original research proposals, and development of thesis and dissertation research studies.

PSYC 622 Research Methods in Clinical Psychology (3 credits)
Restriction: Permission of instructor. Credit only granted for: PSYC622 or PSYC718. Formerly: PSYC718.
Examines issues and strategies in conceptual systems, designs and methodologies of current research in clinical and community psychology. Readings include critical analyses of published research. Course requirements include preparation of a research proposal for a thesis level study.

PSYC 623 Child Psychopathology (3 credits)
Restriction: Permission of instructor; and must be in one of the following programs (Psychology (Master's); Psychology (Doctoral)).
Examines the scientific and clinical literature relevant to normal and pathological behavior in children and adolescents. Issues in developmental psychopathology and consideration of processes initiated in childhood which manifest as pathology in adulthood are also considered.

PSYC 624 Adult Psychopathology (3 credits)
Restriction: Permission of instructor; and must be in one of the following programs (Psychology (Master's); Psychology (Doctoral)). Credit only granted for: PSYC624 or PSYC719. Formerly: PSYC719.
Examines the scientific and clinical literature relevant to normal and pathological behavior in adults and associated nosological systems for categorizing psychopathology. Issues relevant to etiology, differential diagnosis, and treatment planning are also considered.

PSYC 625 Clinical Assessment: Psychometric Principles, Testing and Behavior (3 credits)
Restriction: Permission of BSOS-Psychology department. Credit only granted for: PSYC625 or PSYC721. Formerly: PSYC721.
An examination of fundamental principles of psychological assessment; application of these principles to the development of

evidence-based assessments of clinical conditions and associated behaviors; and application of evidence-based assessments to the evaluation and understanding of clinical conditions evaluated and treated in therapeutic settings.

PSYC 628 Advanced Topics in Clinical Psychology (1-3 credits)
Restriction: Permission of instructor. Repeatable to 9 credits if content differs. Credit only granted for: PSYC628 or PSYC719. Formerly: PSYC719.
Examines selected topics in clinical/community psychology, public policy and health care planning.

PSYC 629 Clinical Laboratory (1-3 credits)
Repeatable to 15 credits. Credit only granted for: PSYC629 or PSYC632. Formerly: PSYC632.
Provides advanced supervised experience in the delivery and supervision of mental health interventions targeted to individuals. Supervised work with clients is required.

PSYC 630 Behavioral and Cognitive Behavioral Intervention for Adults (3 credits)
Prerequisite: PSYC680. Restriction: Permission of instructor. Credit only granted for: PSYC630 or PSYC728. Formerly: PSYC728.
Introduces students to the process of therapy with particular focus on behavioral focus on behavioral and cognitive behavioral internentions. Syllabus focuses on theory, research, client diversity, ehtics, and practical aspects of conducting therapy.

PSYC 632 Behavioral and Cognitive Behavioral Intervention for Children and Adolescents (3 credits)
Restriction: Permission of instructor; and must be in one of the following programs (Psychology (Master's); Psychology (Doctoral)). Formerly: PSYC789A.
Introduces students to the process of therapy with particular focus on behavioral and cognitive behavioral interventions in children and adolescents. Syllabus focuses on theory, research, client diversity, ethics and practical aspects of conducting therapy.

PSYC 638 Externship in Professional Psychology (1-3 credits)
Repeatable to 6 credits if content differs.
Approved appointment as an extern in a mental health setting.

PSYC 639 Internship in Professional Psychology (1 credits)
Repeatable to 6 credits if content differs.
This seminar combines involvement with a program approved appointment as an intern in a mental setting with a supervisory review of the training experience.

PSYC 642 Biological Considerations in Clinical Psychology (3 credits)
Behaviors are based partially in the bilogy of the human organism. This course begins with an examination of the nature-nurture issue on psychology, particularly as it applies to clinical psycology. Genetic underpin nings of behavior & their neuroanatomical & neurochemical expressions will be explored. This course will also examine psychopsychiological meas ures and the role of psychoparmacology and other biological interventions in treatment.

PSYC 643 Ethical and Professional Issues in Clinical Psychology (3 credits)
Restriction: Permission of instructor; and must be in one of the following programs (Psychology (Master's); Psychology (Doctoral)). Credit only granted for: PSYC643 or PSYC719. Formerly: PSYC719.
An overview of the ethical and professional issues involved in psychological research, instruction, and practice, with special attention to advocacy and ethical decision making regarding a variety of primary, secondary, and tertiary clinical/community interventions.

PSYC 644 Basic Foundation of Clinical Interventions (3 credits)
Restriction: Permission of instructor; and must be in one of the following programs (Psychology (Master's); Psychology (Doctoral)).
General introduction to behavior theory and the basic behavioral principles that underlie behavior therapy. Provides an introduction to the philosophical, theoretical and empirical contributions of basic behavior analysis as they relate to behavior therapy, including examples of how behavior therapy is disconnected from its roots.

PSYC 650 Culture and Diversity in Mental Health (3 credits)
Restriction: Must be enrolled in the Clinical Psychological Science MPS program.
Review literature regarding the role of culture and diversity in mental health and how culture and diversity are integrated into research and are related to mental health and mental health service utilization. Examine principles and concepts of multicultural and cross-cultural psychology to acquire an increased understanding of diverse underrepresented groups and topics to consider when involved with research and/or clinical work with individuals having diverse backgrounds (e.g., cultures, ethnicities, genders, sexual orientations, and socioeconomic status).

PSYC 651 Writing and Critical Thinking (3 credits)
Restriction: Must be enrolled in and have completed 4 terms of the Clinical Psychological Science MPS program.
A capstone experience to integrate knowledge learned throughout the program and improve critical thinking and research writing skills. This will be done through the production of a major research paper in an area relevant to the current or future career goals of the student and by emphasizing critical thinking skills.

PSYC 652 Analytical Thinking: Statistical Methods at Work (3 credits)
Additional information: Students will be taught how to conduct analyses in R, SPSS, SAS, Stata, and excel; students are encouraged to practice analyses on at least two of these programs.
Personal and organizational growth begins with asking and answering great questions. Correspondingly, this course begins with demonstrations of how to translate business questions into research questions. Statistical methods used to answer business questions are taught first conceptually, then computationally using statistical software. This course emphasizes interpreting results, the regression model, and other issues salient to business research, such as handling large datasets. Students will be provided with a simulated dataset that they will use in learning how to frame and answer business questions using the techniques covered in this course. At the conclusion of this course, students will be required to provide an executive-level presentation on the business question, their findings, and resulting implications.

PSYC 662 Understanding Trauma and Recovery I (3 credits)
Restriction: Must be in the Graduate Certificate of Professional Studies in Treating Survivors of Violence, Torture, and Trauma: Theoretical Foundations and Mental Health; or permission of instructor.
This course is designed to provide students with an overview of psychological trauma and an introduction to treatment of trauma survivors. Current theoretical approaches to understanding trauma and treatment from psychological, developmental, neurobiological, cognitive, and ecological perspectives will be presented.

PSYC 663 Understanding Torture and Trauma I (3 credits)
Restriction: Must be in the Graduate Certificate of Professional Studies in Treating Survivors of Violence, Torture, and Trauma: Theoretical Foundations and Mental Health; or permission of instructor.
The focus of this course is to provide students with an introduction to the psychology of torture survivors. Students will discuss theoretical approaches to understanding of torture, think critically about the context of torture, and understand the psychological, social/familial, spiritual, physical, community, and political implications of torture. Interventions for working with torture survivors will be introduced.

PSYC 664 Understanding Trauma and Recovery II (3 credits)
Prerequisite: PSYC662. Restriction: Must be in the Graduate Certificate of Professional Studies in Treating Survivors of Violence, Torture, and Trauma: Theoretical Foundations and Mental Health; or permission of instructor.
This is the second in a series of two courses designed to provide students with an understanding of psychological trauma and treatment of trauma survivors. Current approaches to understanding and treating trauma survivors from psychological, developmental, neurobiological, cognitive, and ecological perspectives will be presented.

PSYC 665 Understanding Torture and Trauma II (3 credits)
Prerequisite: PSYC663. Restriction: Must be in the Graduate Certificate of Professional Studies in Treating Survivors of Violence, Torture, and Trauma: Theoretical Foundations and Mental Health; or permission of instructor.
This is the second course in a searies of two classes focused on theory, research, and psychological interventions related to the treatment of survivors of torture and trauma. Current approaches to treatment of torture survivors, as well as psychological, social/familial, spiritual, physical, community, and political implications of torture will be introduced.

PSYC 669 Professional Issues in Counseling Psychology (1 credits)
Restriction: Must be in the Counseling Psychology program. Repeatable to 3 credits if content differs. Also offered as: EDCP669.
Introduction to counseling psychology, including history and development of the field, and current professional and scientific issues. Exploration of career, research, and professional development opportunities.

PSYC 678 Seminar in Psycholinguistics (3 credits)
Prerequisite: PSYC671. Repeatable to 6 credits.
Contemporary psycholinguistic theories of language acquisition and use. Phonological, semantic and syntactic aspects of language.

PSYC 679 Seminar in Cognitive Development (3 credits)
Prerequisite: PSYC611 or PSYC671. Repeatable to 6 credits.
Advanced coverage of research methodology and research issues in various areas of cognitive development such as categorization, spatial understanding, language acquisition, and memory. Emphasis on interrelationships among developmental changes across the life-span. Utility of a developmental perspective in analyzing the components of cognition.

PSYC 682 Counseling Psychology Didactic-Practicum in Group Interventions (3 credits)
Restriction: Permission of instructor. Credit only granted for: PSYC682 or PSYC729. Formerly: PSYC729.
In depth examination of theories and techniques of group interventions, and supervised experience in group counseling.

PSYC 683 Counseling Psychology Didactic-Practicum in Couples and Family Interventions (3 credits)
Restriction: Permission of instructor. Credit only granted for: PSYC683 or PSYC729. Formerly: PSYC729.
In depth examination of theories and techniques of couples and family counseling, and supervised experience in couples/family counseling.

PSYC 685 Counseling Psychology Didactic-Practicum in Counseling Supervision (3 credits)
Restriction: Permission of instructor. Credit only granted for: PSYC685 or PSYC729. Formerly: PSYC729.
In depth examination of theories and techniques of counseling supervision, and supervised experience in the process of supervising counselors.

PSYC 688 Ethicial and Legal Issues in Counseling Psychology (1 credits)
Restriction: Must be in the Counseling Psychology program. Repeatable to 3 credits if content differs.
Exploration of ethical standards and legal issues in the profession of counseling psychology.

PSYC 689 Seminar in Counseling Psychology (3 credits)
Restriction: Permission of instructor. Repeatable to 12 credits if content differs. Credit only granted for: PSYC689 or PSYC719. Formerly: PSYC719.
Special topics in counseling psychology. Examples of topics include multi-cultural counseling, the counseling relationship, counseling and victimology, psychological treatment and health.

PSYC 690 Research in Counseling Psychology I (3 credits)
Restriction: Permission of instructor. Credit only granted for: PSYC690 or PSYC718. Formerly: PSYC718.
Critical analysis of strategies methodological, conceptual, and content trends.

PSYC 691 Research in Counseling Psychology II (3 credits)
Restriction: Permission of instructor. Credit only granted for: PSYC691 or PSYC718. Formerly: PSYC718.
Critical analysis of trends and issues in counseling psychology science.

PSYC 692 Assessment in Counseling Psychology I (3 credits)
Prerequisite: PSYC680. Credit only granted for: PSYC692 or PSYC721. Formerly: PSYC721.
Broad introduction to the construction of psychological tests and measures, and experience in test interpretation, with consideration of historical, legal, ethical, and cultural issues surrounding the assessment process.

PSYC 693 Assessment in Counseling Psychology II (3 credits)
Prerequisite: PSYC692. Credit only granted for: PSYC693 or PSYC722. Formerly: PSYC722.
Supervised experience in administration, scoring, and interpreting major psychodiagnostic instruments used by counseling psychologists, as well as writing integrative assessment reports. Emphasis on hypothesis testing approach to assessment and on the counseling interview as an assessment tool.

PSYC 695 Ethical and Professional Issues in Counseling Psychology (3 credits)
Restriction: Must be in the Counseling Psychology program. Also offered as: EDCP695. Credit only granted for: EDCP669, EDCP688, EDCP695, PSYC688, or PSYC695. Formerly:

EDCP669 and EDCP688.
Exploration of ethical and professional issues in Counseling Psychology.

PSYC 697 Multicultural Issues (3 credits)
Restriction: Must be in the Counseling Psychology program. Also offered as: EDCP697. Credit only granted for: EDCP697, EDCP699, or PSYC697. Formerly: EDCP699.
Exploration of knowledge, attitudes and skills for providing counseling and psychological services to culturally diverse populations.

PSYC 698 Advanced Didactic-Practicum in Counseling Psychology (3 credits)
Restriction: Permission of instructor. Repeatable to 12 credits if content differs. Formerly: PSYC729.
In depth examination of approaches to or theories about intervention, and supervised experience in the application of those approaches or theories. Each practicum focuses on a particular approach, e.g, psychodynamic, cognitive-behavioral, cross-cultural.

PSYC 699 Diversity and Multiculturalism in Counseling Psychology (1 credits)
Restriction: Must be in the Counseling Psychology program. Repeatable to 3 credits if content differs. Formerly: EDCP696.
Exploration of knowledge, attitudes, and skills for providing counseling psychological services to culturally diverse populations.

PSYC 700 Theories and Strategies of Counseling Psychology (3 credits)
Restriction: Permission of BSOS-Psychology department. Credit only granted for: PSYC700 or PSYC711. Formerly: PSYC711.
Introduction to the professional field, examination of pertinent scientific and philosophical backgrounds, and survey of the major theories, principles, and training models in counseling. Correlated laboratory analogue experiences in dyadic and group interrelationships.

PSYC 701 Multivariate Analysis I (3 credits)
Prerequisite: PSYC602; or permission of instructor.
Fundamentals of maxtrix algebra, multivariate distributions, multivariate estimation problems and test of hypotheses, general linear model.

PSYC 705 Mathematical Models of Memory and Cognition (3 credits)
Prerequisite: PSYC602; or permission of instructor.
Topics to be covered include a review of basic probability theory; models of learning, memory and attention; stimulus sampling theory; computer simulations of cognitive processes.

PSYC 707 Theory of Decision and Choice (3 credits)
Prerequisite: PSYC602. Restriction: Permission of instructor.
A study of algebraic and probabilistic models for decision and choice behavior, and related experimental procedures. Topics include: measurement of preference, subjective utility models for certain and uncertain outcomes, normative strategies, decision making styles, and group decision making.

PSYC 708 Seminar in Psychometric Theory (3 credits)
Prerequisite: PSYC602; or permission of instructor. Repeatable to 9 credits if content differs.
Study of the current practices, trends, or recent developments in psychometric theory.

PSYC 709 Seminar in Mathematical Models (3 credits)
Prerequisite: PSYC602; or permission of instructor. Repeatable to 9 credits if content differs.
Special topics in mathematical psychology. A discussion of quantitative representations of psychological processes in one or more substantive areas of psychology.

PSYC 725 Teams at Work (3 credits)
Prerequisite: PSYC602; or permission of instructor. Credit only granted for: PSYC725 or PSYC747. Formerly: PSYC747.
Theory and research regarding the formation, management, and functioning of teams in the workplace; including team composition, team rewards, team-task and team-organization relationships and fit, team productivity, and the selection for and training of teams. International use of teams at work.

PSYC 732 Selection and Classification Issues in Organizations (3 credits)
Prerequisite: PSYC603; and (PSYC602; or students who have taken courses with comparable content may contact the department). Or permission of instructor.
Consideration of societal, organizational and individual demands for appropriate use of individual differences in (primarily) initial placement of employees. Recruitment, and selection issues, the role of governmental regulations, and the role of individual factors in individual behavior are considered. Extensive coverage given to fundamental psycho-metric problems and the development of individual and organizational criteria of effectiveness.

PSYC 737 Research Methods in Industrial/Organizational Psychology (3 credits)
Prerequisite: PSYC603; or permission of instructor.
Philosophy, theory, and method issues underlying I/O psychology. History and the effectiveness of different methods for answering different questions is explored. Reliability and validity are emphasized.

PSYC 738 Seminar in Industrial/Organizational Psychology (3 credits)
Prerequisite: PSYC603; or permission of instructor. Repeatable to 99 credits if content differs.
An occasional advanced seminar covering specialized topics.

PSYC 739 The Psychology of Workplace Change and Innovation (3 credits)
Prerequisite: PSYC603; or permission of instructor.
Organizational change and innovation research and theory, current impetuses for organizational change (e.g., economic, demographic, and technological trends) and specific workplace innovations (e.g., employee ownership, QWL, CAD/CAM, etc.)

PSYC 740 Social Psychology Research Methodology (3 credits)
A review of research methodology in social psychology, including research design, techniques of data collection, and the interpretation of data. Emphasis is placed on developing skill in evaluating studies and generating research designs.

PSYC 742 Group Processes (3 credits)
Research and theory concerning a) intra-group behavior, including topics such as group formation, conformity, group task performance and decision-making, minority influence, and jury decision-making, and b) inter-group behavior, including the processes of social categorization, stereotype development and change, and issues of prejudice and discrimination.

PSYC 743 Social Cognition (3 credits)
Research and theory concerning the attribution of personal characteristics, errors and biases in social judgment, social information processing, person memory, motivated social-cognition and cognition in groups.

PSYC 748 Seminar in Social Psychology (3 credits)

Repeatable to 15 credits if content differs.
A seminar on selected topics in social psychology.

PSYC 749 Current Research in Social Psychology (1-3 credits)
Repeatable to 12 credits if content differs.

PSYC 757 Developmental Cognitive Neuroscience (3 credits)
Restriction: Must be in one of the following programs (Psychology (Master's); Psychology (Doctoral); Neurosciences and Cognitive Sciences (Doctoral)) ; or permission of BSOS-Psychology department. Credit only granted for: NACS728D or PSYC757.
Developmental cognitive neuroscience investigates the relations between neural and cognitive development. This course provides an overview of current research questions, methodologies and findings related to neurocognitive development in human infants and children, the role of developmental plasticity, and atypical outcomes, such as those observed in neurodevelopmental disorders.

PSYC 758 Seminar in the Neural Bases of Sensory Processes (3 credits)
Prerequisite: PSYC605; or permission of instructor. Repeatable to 9 credits if content differs.
Selected topics in vision and the other senses.

PSYC 759 Seminar in Neural Bases of Perceptual Processes (3 credits)
Prerequisite: PSYC605; or permission of instructor. Repeatable to 9 credits if content differs.
Selected topics in perceptual phenomena and their physiological bases.

PSYC 764 Comparative Neuroanatomy (3 credits)
Restriction: Permission of instructor.
Demonstrations and lectures on the gross, microscopic and ultrastructural morphology of the central nervous system of vertebrates.

PSYC 765 Biological Bases of Psychopharmacology (3 credits)
Prerequisite: Must have completed a year of graduate study in psychology.
Restriction: Permission of instructor.
A critical review and detailed analysis of the literature and problems related to the effects of drugs on animal and human behavior. Designed for advanced graduate students in experimental psychology and clinical psychology.

PSYC 768 Conditioning and Learning (3 credits)
Prerequisite: PSYC622.
Alternate years. The literature on the experimental analysis of behavior, with examination of basic experiments and contemporary theories related to them.

PSYC 778 Seminar in Learning and Memory (3 credits)
Prerequisite: PSYC671. Repeatable to 6 credits if content differs.
An advanced topical seminar covering the areas of human learning and memory. Acquisition processes, storage and retrieval processes, and attention and information processing.

PSYC 779 Seminar in Human Performance Theory (3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs. Formerly: PSYC735.
An examination of human-machine interactions with emphasis on theories and research which focus on human performance capabilities and skills. Topics selected from information processing, communications, human computer interaction, decision making, environmental constraints and automation.

PSYC 788 Special Research Problems (1-4 credits)
Supervised research on problems selected from the areas of experimental, industrial, social, quantitative, or mental health psychology.

PSYC 789 Special Research Problems (1-4 credits)

PSYC 798 Graduate Seminar (1-4 credits)
Repeatable to 12 credits if content differs.

PSYC 799 Master's Thesis Research (1-6 credits)

PSYC 818 Research Issues in Personality Or Development (3 credits)
Prerequisite: PSYC602 and PSYC601. And PSYC611 or PSYC612; or students who have taken courses with comparable content may contact the department. Repeatable to 9 credits.
Experimental design and methodology and statistical treatment of data appropriate to personality or developmental research; critical analysis of major current areas of research including methodologies, findings and implications. The course will focus on either personality research or developmental research in a given semester.

PSYC 819 Seminar in Personality and Development (3 credits)
Repeatable to 9 credits.
An advanced seminar covering specialized topics.

PSYC 859 Special Topics in Perception (3 credits)
Prerequisite: PSYC605; or permission of instructor. Repeatable to 6 credits.
Intensive study of selected topics in perception.

PSYC 878 Current Research in Language and Cognition (3 credits)
Prerequisite: PSYC671. Repeatable to 6 credits.
Seminar will cover current research and methodological issues in language and cognition. Specialized topics include: computer models of cognitive behavior; cross-cultural studies in language and thought; mathematical and analytical techniques for assessing structures; and others.

PSYC 888 Research Methods in Psychology (1-3 credits)

PSYC 889 Research Methods in Psychology (1-3 credits)

PSYC 898 Pre-Candidacy Research (1-8 credits)

PSYC 899 Doctoral Dissertation Research (1-8 credits)

Public Affairs (PUAF)

PUAF 610 Quantitative Aspects of Public Policy (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Introduces statistical methods needed for evaluating and choosing among policy options. Topics include probability; decision-making under uncertainty; the organization, interpretation, and visual display of complex data; prediction and inferences about causality; hypothesis testing; and linear and multiple regression. Develops analytical skills and the ability to apply theory to complex, real-world problems.

PUAF 611 Quantitative Analysis of Policy Issues (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Study of a series of problems and the

development of quantitative techniques to describe or evaluate the problem. The organization and interpretation of complex data and its use for prediction and inference about casual effects. The definition of objectives, trade-offs among objectives, and allocation of resources to meet objectives. Sensitivity of outcomes to changing conditions.

PUAF 620 Political Analysis (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Examination of politics as a process for allocating scarce resources among claimants for public benefits. Comparision of the allocative model of politics with other distributive processes, such as markets. Comparison of the model with behavior of different political institutions, such as Congress and the presidency. Study of politics as a process with distinctive concepts of rationality. The translation of voter and interest group preferences into public choices. The impact of political decisions on competing constituencies.

PUAF 640 Microeconomic and Policy Analysis (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Applies intermediate microeconomic theory to public policy issues: resource allocation by firms and consumers; the response of economic agents to changes in incentives; market allocations in competitive and non-competitive environments; and market failures and government remedies. Uses extended case studies of particular issues in such areas as the environment (acid rain), international trade (tariffs), industry regulation (cable TV), and the provision of public goods (highways).

PUAF 641 Macroeconomics and Policy Analysis (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Studies the behavior of the economy as a whole: the level of national income, unemployment, and inflation; the vulnerability of the U.S. economy to external influences; possible federal influence over the level of economic activity; and the consequences for prices, employment and the U.S. trade deficit. Also examines possible U.S. policy responses to widespread debt crises in developing countries.

PUAF 650 Moral Dimensions of Public Policy (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Explores the moral issues involved in public policy questions; the limits and usefulness of decision-making tools; problems of choosing, justifying and using criteria to judge a program's success and suitability; ethichal issues involving the welfare state and income distribution; and possible obligations beyond one's political community and generation.

PUAF 660 Environmental Policy Workshop (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Students work as a team to analyze and recommend responses to a current enviornmental policy issue. Emphasizes problem definition, organization of information and presentation of results.

PUAF 670 Public Budgeting & Financial Management (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Covers how governments raise, spend, borrow, and manage public funds. Reviews federal,state, and local budget processes and introduces analytical techniques including basic spreadsheet skills, evaluating alternative revenue sources, revenue and expenditure forecasting, cost allocation, capital budgeting, cost-benefit analysis, discounting and present value, bond analysis, cash management and intergovernmental finance.

PUAF 671 Public Sector Finance (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
The goal of this course is to provide a useful overview of basic public sector financial management principles in a simulated managerial situation to midcareer students currently working in government and nonprofit organizations.

PUAF 688 Topics in Public Policy (1-3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of instructor. Repeatable to 18 credits if content differs.
Special topics in Public Policy.

PUAF 689 Public Policy Topics (1-3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of instructor. Repeatable to 18 credits if content differs.
Special Topics in Public Policy.

PUAF 692 Leadership Principles and Practices (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
This course will introduce leadership principles and practices to students by focussing on the theory of leadership, different leadership themes and skills, and discussions with practitioners.

PUAF 698 Selected Topics in Public Affairs (1-3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Special topics that arise in public policy.

PUAF 699 Selected Topics Public Policy (1-3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; and permission of PUAF-School of Public Policy.
Special topics that arise in public policy.

PUAF 700 U.S. Trade: Policy and Politics (3 credits)
Prerequisite: PUAF641, PUAF620, and PUAF640. Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Interplay between government and private interests in shaping official actions that affect international trade. Policy tools available to influence balance, magnitude, and composition of imports and exports. Evolution of executive, congressional and quasi-judicial government institutions under increased U.S. international trade exposure and trade deficit.

PUAF 706 Public Policymaking for Journalists (3 credits)
Restriction: Must be in a major in JOUR-Philip Merrill College of Journalism.
Focuses on the political, procedural and administrative realities of policy formation and implementation. Specifically for the Journalism students who staff the Capital News Service.

PUAF 711 Public Management and Leadership (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Reviews the managerial, political, and ethical problems faced by public sector managers and leaders, including setting an organization's goals, obtaining and protecting a program mandate, designing a service delivery system and implementing a new program.

PUAF 712 Analysis of Fiscal Conditions (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
The financial operations of U.S. government at various levels, with emphasis on local governments. Practical problems in revenue management, including revenue forecasting and cash flow analysis; debt management operations, such as borrowing; intergovernmental financial operations, such as grants management and reporting requirements, and personnel management issues that have a direct bearing on governmental finances.

PUAF 715 Government and Non-Profit Accounting (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Basic accounting practices of governmental and non-profit organizations. Emphasis on presentation of data in assessing an organization's financial health, financial data by organizations, structuring of accounting information to achieve management control, way in which evolving national standards influence kinds of information organizations have to apply in the future.

PUAF 716 State and Local Government Budgeting (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
State and local government practices as a laboratory for studying public sector financial management.

PUAF 717 Federal Budgeting: Policy and Process (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Budgeting as a political and administrative instrument of government. Development of budgeting, the multiple uses of the budget, including role in fiscal policy and resource allocation, the roles and relationships of major participants, and effects of resource scarcity on budgeting behavior. Emphasis on the federal level.

PUAF 720 International Security Policy (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Reviews the principal features of international security as currently practiced. Traces the evolution of contemporary policy beginning with the initiation of nuclear weapons programs during World War II. Particular emphasis is given to experience of the United States and Russia, since the historical interaction between these two countries has disproportionately affected the international security conditions that all other countries now experience.

PUAF 722 Terrorism and Democracy (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
United States government's decision process for dealing with crises; the options available to a president for deterring and handling incidents of terrorism, and how a president can and should select between the options.

PUAF 724 Problems of Global Security (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Formerly: PUAF698W.
Explores the international security implications of globalization, presenting evidence indicating that altered circumstances will eventually induce a major redesign of prevailing security arrangements. Includes three segments: 1) a review of the principal problems that have been the focus of established security policy and would be the context for any major adjustment of policy; 2) an assessment of relationships with the major countries where traditional problems are most acutely present; and 3) a review of the organizing principles that can be expected to emerge in the new situation.

PUAF 732 Policy and Politics of Education Reform (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Examines education reform in its historical, fiscal, cultural, and legal contexts, and the changing relationship between education and economic opportunity. Focuses on institutional and normative issues, including national standards, public school choice, charter schools, vouchers and funding equity.

PUAF 734 Foundations of Social Policy (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy.
Provides an overview of government's role in social policy and the history of the development of federal and state policies with respect to welfare, aging, education, and housing. Analyzes current federal institutions and legislation in the same policy areas and the demographic history of the United States. Develops skills in analytic writing and presentation of descriptive data.

PUAF 735 Health Policy (3 credits)
Analyzes the origins, history, status, and future of health care as problems in political and economic theory and as puzzles in policy formation. Considers current American reform controversies in the light of several disciplines and in comparison to foreign experiences and structures.

PUAF 736 Managing Social Services (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Credit only granted for: PUAF736 or PUAF698V. Formerly: PUAF698V.
Focuses on managing social services across federal, state, and local jurisdictions with an emphasis on how strong management can improve results. Exposes students to management thought and philosophy as applied to different social services and social policy challanges within various operating environments and programmatic settings. The watchwords for this course are "management" and "applied".

PUAF 737 Strategies of Equality (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Formerly: PUAF698Y.
Concentrates on the institutional and political means by which disadvantaged segments of the United States population have sought to enhance their social, economic and political prospects. Race, gender and disability are the substantive focal points, with considerable attention given to the challanges of African American socio-political uplift. Also explores legislation, litigation, administration, agitation (i.e. protest), and constitutional reform. Students become familiar with alternative conceptions of equality and the modes of argument employed in different institutional and political contexts.

PUAF 740 Public Policy and the Environment (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Surveys of major federal environmental legislation; the development and implementation of laws, and alternative ways of thinking about the relationship between humans and the environment.

PUAF 741 Global Environmental Problems (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Suitability of analytic tools for examining

global environmental problems, human overpopulation, land abuse, ozone depletion, climate change, acid rain, loss of biological diversity, the scarcity of food, fresh water, energy and nonfuel mineral resources, and health hazards of pollutants toxic metals and radiation.

PUAF 742 Environmental Ethics (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Analyzes issues such as the relation between human beings and nature from the perspectives of the science, history, philosophy, and religion. Considers the bases for policies such as environmental regulation, public lands, and international conventions with respect to the environment.

PUAF 743 Ecological Economics (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Explores how taking account of the economic system's fundamental dependence on the environment alters conventional economic goals, priorities, theories, and prescriptions.

PUAF 744 Environment and Development (3 credits)
Analyzes sustainable development and its conflicting interpretations. The dominant view, as expressed in the World Bank's 1992 World Development Report, is studied, along with some critical responses. Further readings on issues of population, consumption and development indicators.

PUAF 745 Human Health and Environmental Policy (3 credits)
Reviews the major human physiological systems and their integrated toxicological functions; considers key bodily defenses; and discusses classic, emerging, and ambiguous risks; in all ecological context. Applies to scientific controversy, the methods of policy formation, such as risk analysis, social-cost analysis, "outcomes" analysis, and decision analysis, all in political-economic context.

PUAF 746 Dynamic Modeling for Environmental Investment and Policy Making (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Formerly: PUAF698M.
Examines the theory, methods and tools to dynamic modeling for policy and investment decision making, with special focus on environmental issues. Provides extensive hands-on modeling experience and makes use of state-of-art computing methods to translate theory and concepts into executable models.

PUAF 752 Managing Differences:Resolving Conflict and Negotiating Agreements (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Enhances the student's negotiation and leadership skills for managing differences between individuals and groups. Students study the nature of conflict, learn how to handle two and multiparty conflicts, exerting leadership where there are no hierarchy leaders, and explore the impact of facilitators and mediators on the negotiating process. Blends skill building exercises and theory discussions about the behavior of groups and individuals in groups to understand negotiation dynamics.

PUAF 753 Advanced Negotiations (3 credits)
Prerequisite: PUAF752. Credit only granted for: PUAF698C or PUAF753. Formerly: PUAF698C.
Deepens the student's negotiation and leadership skills for managing differences between individuals and groups. Cover conflict, escalation, dealing with intractable conflicts, sustaining agreements in inter-group conflicts, and the effects of trauma on negotiations.

PUAF 770 Seminar in Housing and Community Development Strategies (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy.
Detailed examination of community and social policy issues relating to the construction and management of affordable housing.

PUAF 771 Housing and Community Development Overview (3 credits)
Restriction: Must be enrolled in the executive training program sponsored by the Department of Housing and Urban Development.
An overview of the housing development process. Community development context, financial analysis, analytical tools including microcomputer applications, architectural and design issues, engineering constraints.

PUAF 772 Housing Finance (3 credits)
Restriction: Must be enrolled in the executive training program sponsored by the Department of Housing and Urban Development.
Fundamentals of housing investment analysis. Structuring feasibility analyses, appraisals, pro forma statements, return on investment, leverage analysis, underwriting ratios, taxation and syndication.

PUAF 773 Housing Clinic (3 credits)
Restriction: Must be enrolled in the executive training program sponsored by the Department of Housing and Urban Development.
Issues and strategies applicable to urban, suburban, and rural areas. Field experience and a team exercise, using the case study method, will give an opportunity for concrete application of the concepts to a specific set of community problems.

PUAF 774 Asset Management (3 credits)
Restriction: Must be enrolled in the executive training program sponsored by the Department of Housing and Urban Development.
Asset manager's role at each stage of the property's life cycle and property analysis, including cash flow debt and staffing. Topics include capital needs; major building systems, costs and useful lives; marketing and outreach; and anti-crime strategies. Field trips to problem properties to perform cost/benefit analysis, diagnose potential cures, and prepare action plans.

PUAF 780 The American Foreign Policy-Making Process (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Survey and analysis of the governmental institutions and processes which shape U.S. global engagement on national security and international economic issues. Particular emphasis is given to executive-congressional relations and the broader domestic roots of foreign policy.

PUAF 781 International Economic Policy (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.
Issues and choices facing the United States in today's global economy. Primary, but not exclusive, emphasis is given to "competitive interdependence" among advanced industrial societies.

PUAF 782 International Development Economics (3 credits)
Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Credit only granted for: PUAF698U or PUAF782. Formerly: PUAF698U.

Examines key current economic and policy issues for developing and transition economies. Topics include inflation stabilization, fiscal policy, selected trade issues, dealing with international capital flows, the role of multilateral organizations, such as the International Monetary Fund and the World Bank, and issues relating to saving, investment and growth.

PUAF 783 Development and Foreign Aid (3 credits)

Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Formerly: PUAF698Q.

Examines the empirical, conceptual, and ethical dimensions of international development policies and U.S. foreign aid. What is the present character of development in poor countries/regions? How should development be conceived? What development strategies are best? What is and should be the purpose of U.S. foreign aide and development assistance?

PUAF 784 Disease, Disaster, and Development (3 credits)

Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy. Credit only granted for: PUAF699D or PUAF784. Formerly: PUAF699D.

Studies development, the process by which needy people in fragile societies become self-sufficient people in resilient societies, in relation to disease and disaster, with particular attention to the developed world's response.

PUAF 790 Project Course (3 credits)

Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.

Students work at a sponsoring government agency or private firm researching problem of interest to sponsor and relevant to concentration. Emphasis on problem definition, organizing information, and both oral and written presentation of results.

PUAF 798 Readings in Public Policy (1-3 credits)

Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.

Guided readings for discussions on public policy.

PUAF 898 Pre-Candidacy Research (1-8 credits)

PUAF 899 Doctoral Dissertation Research (1-8 credits)

Restriction: Must be in a major in PUAF-School of Public Policy; or permission of PUAF-School of Public Policy.

Real Estate Development (RDEV)

RDEV 630 Fundamentals of Real Estate Development and Finance (3 credits)

Restriction: Must be in Real Estate Development (Master's) program; or permission of ARCH-Real Estate Development. Credit only granted for: RDEV630, RDEV688B, or URSP664. Formerly: RDEV688B.

An introduction to real estate development and the foundational concepts of finance and particular financial measures in underwriting real estate projects. Quantitative analyses and financial modeling comprise the main focus.

RDEV 635 Capital Markets and Real Estate Investments for Developers (3 credits)

Prerequisite: RDEV630, URSP664, or RDEV688. Restriction: Must be in Real Estate Development (Master's) program; or permission of ARCH-Real Estate Development. Credit only granted for: RDEV635 or RDEV688F. Formerly: RDEV688F.

An advanced course in real estate finance focusing on capital markets and complex financing mechanism in the public and private markets for raising capital for development of public, private and public/private projects.

RDEV 650 Essentials of Design and Construction Management for Development Professionals (3 credits)

Restriction: Must be in Real Estate Development (Master's) program; or permission of ARCH-Real Estate Development. Credit only granted for: RDEV650 or RDEV688C. Formerly: RDEV688C.

Essential terminology, process and substantative knowledge needed by development professionals to effectively move a project through the design and construction process; includes environmental and ethical considerations throughout the process.

RDEV 688 Selected Topics in Real Estate Development (3 credits)

Prerequisite: Permission of ARCH-Real Estate Development. Repeatable to 8 credits if content differs.

Selected topics in real estate development.

RDEV 689 Current Topics in Real Estate Development (1-3 credits)

Explores a focused aspect in any of the five major phases of real estate development: planning, finance, law, design, construction, or management.

Religious Studies (RELS)

RELS 400 Methods and Theories in the Study of Religion (3 credits)

Also offered as: RELS600. Credit only granted for: RELS400, RELS419T,RELS600, or RELS619T. Formerly: RELS419T.

An exploration of scholarly approaches to the study of religion. The modern history of the secular study of religion, social dynamics, textual formations, and ritual practices.

RELS 419 Advanced Topics in Religious Studies (3 credits)

Recommended: RELS216. Repeatable to 9 credits if content differs.

The contemporary study of religion in which topics may address specific religious traditions, regional or historical developments, or methodological and theoretical issues.

RELS 429 Advanced Topics in Religious History (3 credits)

Recommended: RELS216 or RELS289. Repeatable to 9 credits if content differs.

Advanced study of religious history in a particular setting, with attention to particular themes, texts, events, or communities.

RELS 430 Dead Sea Scrolls (3 credits)

Credit only granted for: JWST429Q, RELS419Q, or RELS430. Formerly: RELS419Q.

A study of the Dead Sea Scrolls in their ancient and modern settings, and in terms of contemporary scholarly interpretations of their meaning. Interpretations of the historical significance of these documents, their connections to ancient Jewish sectarian movements, and their implications for our understanding of Judaism, Christianity, and the history of the Bible.

RELS 439 Advanced Topics in Religious Thought (3 credits)

Recommended: RELS216 or RELS289. Repeatable to 9 credits if content differs.

Advanced study of religious thought in a particular setting, with attention to particular themes, texts, events, or communities.

RELS 499 Independent Study in Religious Studies (1-3 credits)
Prerequisite: Permission of ARHU-Meyerhoff Program & Center for Jewish Studies. Repeatable to 6 credits if content differs.
An advanced independent research project for qualified students, supervised by a faculty member, on a topic not ordinarily covered in available courses.

RELS 600 Methods and Theories in the Study of Religion (3 credits)
Also offered as: RELS400. Credit only granted for: RELS400, RELS419T, RELS600, or RELS619T. Formerly: RELS619T.
An exploration of scholarly approaches to the study of religion. The modern history of the secular study of religion, social dynamics, textual formations, and ritual practices.

RELS 619 Directed Readings in Religous Studies (3 credits)
Repeatable to 6 credits if content differs.
Individual Instruction course.

Russian (RUSS)

RUSS 401 Advanced Russian Composition (3 credits)
Prerequisite: RUSS302; or students who have taken courses with comparable content may contact the department. Restriction: Not open to native speakers of Russian.
Approaches to argumentation, organization of information, contextualized grammar, appropriateness of lexical choice, genre, and register.

RUSS 402 Practicum in Written Russian (3 credits)
Prerequisite: RUSS401; or students who have taken courses with comparable content may contact the department.
Designed to improve comprehension of functional varieties of written Russian and develop ability to present in written form concise syntheses of source texts.

RUSS 403 Russian Conversation: Advanced Skills (3 credits)
Prerequisite: RUSS303; or students who have taken courses with comparable content may contact the department.
Advanced spoken production of high-level, abstract language.

RUSS 404 Practicum in Spoken Russian (3 credits)
Prerequisite: RUSS403; or students who have taken courses with comparable content may contact the department.
To improve comprehension of rapidly spoken Russian of various functional styles and to develop ability to synthesize orally the content of spoken material.

RUSS 405 Russian-English Translation I (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in RUSS302.
Introduction to the principles of translation of a particular genre, and is typically diplomatic, business, or literary.

RUSS 406 Russian-English Translation II (3 credits)
Prerequisite: RUSS405.
Continuation of RUSS405.

RUSS 407 Commercial Russian II (3 credits)
Prerequisite: RUSS307.
Continuation of RUSS307 focusing in the more difficult and complex Russian business documents and Russian business ministries.

RUSS 409 Selected Topics in Russian Language Study (3 credits)
Restriction: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Presentation of a topic in Russian language study.

RUSS 410 Applied Russian Linguistics (3 credits)
The nature of applied linguistics and its contributions to the effective teaching of foreign languages. Comparative study of English and Russian, with emphasis upon points of divergence. Analysis, evaluation and construction of related drills.

RUSS 411 Linguistic Analysis of Russian I (3 credits)
Prerequisite: Must have completed or be concurrently enrolled in RUSS301.
Elucidation of theoretical concepts of modern linguistics through the analysis of problematic concepts in the Russian linguistic system. Phonology and the syntax of the simple sentence.

RUSS 412 Linguistic Analysis of Russian II (3 credits)
Prerequisite: RUSS411.
Continuation of RUSS411. The syntax of the complete sentence, semantics.

RUSS 431 Russian Literature of the 19th Century I (3 credits)

RUSS 432 Russian Literature of the 19th Century II (3 credits)

RUSS 433 Russian Literature of the 20th Century (3 credits)

RUSS 434 Soviet Russian Literature (3 credits)

RUSS 439 Selected Topics in Russian Literature (3 credits)
Restriction: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Presentation of a topic in Russian literature.

RUSS 473 Recent History of the Russian Language (3 credits)
Linguistic interpretation of Russian texts from the late 18th century to the present.

RUSS 499 Independent Study in Russian (1-3 credits)
Prerequisite: Permission of instructor. Repeatable to 6 credits if content differs.
Independent study under faculty supervision.

RUSS 605 Practicum in Russian/English Translation (3 credits)
Prerequisite: RUSS402; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Problems of translation in various modes, such as business, law, diplomacy, and literature.

RUSS 611 Problems in Russian Phonology and Morphology (3 credits)
Prerequisite: RUSS411; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Treatment of Russian phonetics, phonology (including morphophonemics), and morphology.

RUSS 612 Problems in Russian Syntax (3 credits)
Prerequisite: RUSS412; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Treatment of Russian syntax in the framework of current linguistic theory.

RUSS 613 Problems in Russian Semantics (3 credits)
Prerequisite: RUSS412; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Treatment of Russian lexical and grammatical semantics.

RUSS 618 Special Topics in Linguistic Analysis of Russian (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Aspects of Russian linguistics such as stress, verbal, tense, taste, word order, or problems in lexical semantics.

RUSS 619 Seminar in Linguistic Analysis of Russian (3 credits)
Prerequisite: RUSS610; and (RUSS612, RUSS611, or RUSS613). Repeatable to 6 credits if content differs.
Current research in Russian linguistic analysis.

RUSS 673 History of the Russian Language (3 credits)
Prerequisite: SLAV475.
Introduction to historical Russian grammar and phonological developments in Russian.

RUSS 679 Special Topics in Slavic Linguistics (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Topics concerning contrastive, historical, and dialectical Slavic linguistics, in relation to our understanding of grammatical theory.

RUSS 798 Independent Study (1-3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.

RUSS 799 Thesis Research (1-6 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.

Second Language Acquisition and Application (SLAA)

SLAA 498 Second Language Research and Practicum (1-3 credits)
Restriction: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 9 credits if content differs. Additional information: UGRAs register for 1-3 credits. A specific weekly schedule will be determined at the beginning of the semester. Throughout the semester, students will meet with the Graduate Supervisor (GS) once per week to discuss the theoretical and methodological background of the project as well as the broader area behind the research. In addition to the training in theoretical background, the first several weeks of the semester will be devoted to hands-on details of running subjects using a particular method and analyzing data. When this training is complete, UGRAs will work more independently to schedule and run research projects and process the data.
Individualized research and practicum for undergraduate students to work as Undergraduate Research Assistants (UGRA) on existing projects under the supervision of a PhD Graduate Supervisor (GS) in the area of second language acquisition to learn/experience how second language as well as psycholinguistic research is conducted.

SLAA 610 Research and Theories in Second Language Acquisition (3 credits)
Introduction to current theories and research findings Second Language Acquisition (SLA).

SLAA 611 Fundamentals of Foreign Language Acquisition and Instruction (3 credits)
Introduction to theoretical and practical issues relevant to foreign language learning, language acquisition, and curriculum construction.

SLAA 613 Design and Management of Language Learning Environments (3 credits)
A critical analysis of various second language learning environments, including traditional classroom-based models, immersion programs, study abroad, heritage learners, individualized instruction, and self-managed learning.

SLAA 620 Second Language Research Methodologies (3 credits)
Prerequisite: SLAA610; and must have completed or be concurrently enrolled in SLAA611.
An exploration of research methodology in second language acquisition (SLA), with a focus on developing practical skills in data analysis and interpretation. Preparation in both critical evaluation of existing research and design of new research models.

SLAA 629 Special Topics in Sociolinguistics (3 credits)
Repeatable to 9 credits if content differs.
Current topics in research in sociolinguistics.

SLAA 630 Second Language Testing (3 credits)
Prerequisite: SLAA610; or permission of ARHU-School of Languages, Literatures, and Cultures department.
An introduction to basic concepts in the assessment of second language knowledge. Issues of reliability, dependability, construct validity, utility, and washback on instruction are examined.

SLAA 639 Special Topics in Applied Linguistics (3 credits)
Repeatable to 9 credits if content differs.
Current topics in research in applied linguistics.

SLAA 640 Psycholinguistics (3 credits)
Prerequisite: SLAA610; or permission of ARHU-School of Languages, Literatures, and Cultures department.
An introduction to the field of psycholinguistics that covers speech perception, word recognition, sentence and discourse processing, speech production, and language acquisition. Basic concepts, research methods, major research topics, leading theories and related research findings, with implications of psycholinguistic theories and findings for second language studies.

SLAA 649 Special Topics in Second Language Acquisition (3 credits)
Repeatable to 9 credits if content differs.
Current topics in research in second language acquisition.

SLAA 650 Second Language Analysis (3 credits)
Prerequisite: SLAA610; or permission of ARHU-School of Languages, Literatures, and Cultures department.
An overview of the field of linguistics with a particular attention to its application in SLA studies, introduces students to the basic concepts and skills related to the scientific study of language, and provides them with opportunities to apply these concepts and skills in the analysis of language. It covers topics such as phonetics, phonology, morphology, syntax, semantics, language acquisition, and language use.

SLAA 719 Second Language Acquisition and Application Internship (3 credits)
Repeatable to 6 credits if content differs.
Internship at a site to be determined. Topics may include heritage language learning, immersion education, testing and assessment, translation and interpretation, and national language planning and policy.

SLAA 740 Research Issues in Second Language Learning (3 credits)
Credit only granted for: SLAA649L or SLAA740.
Current topics in second language learning research including interlanguage development, negative feedback, maturational constraints, units of acquisition, stabilization/fossilization, aptitude and aptitude training.

SLAA 741 Cognitive Processes in Second Language Learning (3 credits)
Prerequisite: SLAA610; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor.
Examines the roles played by varied types of learning processes and memory, general processing issues, and the cognitive bases of individual differences in learning and processing a second language.

SLAA 742 Second Language Processing (3 credits)
Restriction: Permission of instructor required for MA students.
Covers leading theoretical approaches and experimental methods in second language processing. Draws on research and theories in Second Language Acquisition (SLA), formal linguistics, cognitive grammar, psycholinguistics, and neurolinguistics.

SLAA 743 Interlanguage Studies (3 credits)
Prerequisite: SLAA610; or permission of instructor.
Review of the accepted facts about Interlanguage development and critical look at the many, often mutually exclusive, mechanisms and processes claimed by advocates of different theories of Second Language Acquisition.

SLAA 744 Age Effects in Second Language Learning (3 credits)
Prerequisite: SLAA610. Restriction: Permission of instructor. Credit only granted for: SLAA649M or SLAA744. Formerly: SLAA649M.
Consideration of the empirical evidence for age effects in second language learning and its potential confounds. Critical evaluation of the differing interpretations of these effects and their implications for educational practice, SLA theory, development psychology, and research methodology.

SLAA 749 Special Topics in Second Language Learning (3 credits)
Prerequisite: SLAA610; or permission of instructor.
Current topics in research on Second Language Learning.

SLAA 750 Instructed Second Language Acquisition (3 credits)
Prerequisite: SLAA610.
Survey of studies on effectiveness of SLA instruction within various domains of language, with focus on research design.

SLAA 751 Second Language Classroom Research (3 credits)
Prerequisite: SLAA610.
Critical evaluation of the evolution and current state of second language classroom research, focusing on theoretical concerns, methodological issues, and substantive findings.

SLAA 754 Task-Based Language Teaching (3 credits)
Credit only granted for: SLAA649T or SLAA754. Formerly: SLAA649T.
Overview of Task-Based Language Teaching (TBLT) including needs and means analysis, syllabus design, materials writing, methodology and pedagogy, testing, and evaluation. Theoretical issues addressed include relationship of TBLT to research findings on the psychology of learning and SLA and libertarian approaches to education.

SLAA 759 Special Topics in Second Language Instruction (3 credits)
Prerequisite: Permission of ARHU-College of Arts & Humanities. Repeatable to 12 credits.
Topics in the theory and practice of second language instruction.

SLAA 760 Fundamentals of Second Language Assessment (3 credits)
Prerequisite: SLAA610.
An overview of current assessment models in foreign and second language learning.

SLAA 770 Sociolinguistics in Second Language Acquisition (3 credits)
Restriction: Must not have completed SLAA629 in Fall 2003 or Fall 2005. Credit only granted for: SLAA629 or SLAA770.
Introduces basic sociolinguistic concepts with special emphasis on the context of second language acquisition, including classroom and uninstructed late learning situations.

SLAA 772 Bilingualism and Multilingualism (3 credits)
Prerequisite: SLAA610; or permission of instructor.
Critical exploration of concepts in bilingualism and multilingualism with emphasis on the social environments of second language acquisition, through the lens of cognitive and social frameworks. Implications of bilingualism for memory, affect, language processing and code-switching/mixing, as well as the social implications of knowing and using more than one language.

SLAA 773 The Heritage Language Speaker (3 credits)
Restriction: Permission of instructor required for Master students.
Critical exploration of the theoretical issues and existing experimental research on heritage language learning and use as well as consideration of classroom and curricular implications of heritage language learning.

SLAA 779 Directed Research in Second Language Acquisition and Application (1-3 credits)
Repeatable to 3 credits if content differs.
Directed independent research in Second Language Acquisition or Application. In this capstone project, students engage in independent research under faculty direction.

SLAA 798 Master's Independent Study (1-3 credits)
Repeatable to 6 credits if content differs.

SLAA 799 Master's Thesis Research (1-6 credits)

SLAA 888 Doctoral Independent Study (1-3 credits)
Prerequisite: Permission of ARHU-College of Arts & Humanities. Repeatable to 9 credits if content differs.
Individual instruction course.

SLAA 898 Pre-Candidacy Research (1-8 credits)

SLAA 899 Doctoral Dissertation Research (1-8 credits)

Slavic (SLAV)

SLAV 469 Selected Topics in Slavic Studies (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Presentation of a topic in Slavic studies.

SLAV 475 Old Church Slavonic (3 credits)

Introduction to the language of the oldest recorded Slavic documents. Historical presentation of phonology, morphology, and syntax; reading of texts.

SLAV 479 Selected Topics in Slavic Linguistics (3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.
Presentation of a topic in Slavic linguistics.

SLAV 499 Directed Study (1-3 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 6 credits if content differs.

School of Languages, Literatures and Cultures (SLLC)

SLLC 400 Articulatory Phonetics for Second Language Acquisition and Application (3 credits)
Restriction: Junior standing or higher. Credit only granted for: SLLC400.
The mechanical capabilities of the human vocal apparatus for producing speech sounds, and their terminology and transcription in the International Phonetic Alphabet. Emphasis is on the practical needs of the teacher and student of foreign language, rather than the theoretical linguist or the hearing-and-speech pathologist. The phonetics of major languages are also introduced, with attention to the pedagogy of their phonetics.

SLLC 410 Documentary and Narrative (3 credits)
Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-School of Languages, Literatures, and Cultures department. Also offered as: FILM410. Credit only granted for: SLLC410 or FILM410.
An examination of the relationship between film and reality, focusing on documentary film.

SLLC 411 Experimental Film (3 credits)
Also offered as: FILM411. Credit only granted for: SLLC411 or FILM411.
Introductory survey of European and U.S. American experimental cinema.

SLLC 461 Political Cinema (3 credits)
Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-School of Languages, Literatures, and Cultures department. Also offered as: FILM461. Credit only granted for: SLLC461, FILM461, CMLT498P, or SLLC468P. Formerly: CMLT498P or SLLC468P.
Histories of cinema and politics in the 20th century.

SLLC 463 Screening Time: History and Memory in Cinema (3 credits)
Prerequisite: ENGL245, FILM245, SLLC283, or FILM283; or permission of ARHU-School of Languages, Literatures, and Cultures department. Also offered as: FILM463. Credit only granted for: SLLC463 or FILM463.
An examination of the ways and techniques with which cinema produces a sense of time in the viewer.

SLLC 468 Special Topics in Film Studies II (3 credits)
Repeatable to 12 credits if content differs.
Exploration of topics in film studies beyond national traditions, for example through the lens of theory, genre, auteurship, aesthetic movements in cinema, and/or comparative perspectives. Courses at the 400-level have higher expectations of independent work, including reading and written assignments.

SLLC 471 The Cultural Environment of Global Business (3 credits)
Restriction: Sophomore standing or higher. Credit only granted for: ARHU439B, ARHU439E, ARHU439T, ENES472, SLLC471, SLLC472, or SLLC473. Formerly: ARHU439B.
The goal of this course is to provide students with an understanding of cultural aspects pertaining to global business, and thereby increasing their awareness of the cultural factors that motivate decisions and behavior in the business world. Students will gain an understanding of how the business cultures in the rest of the world diverge from the American, and develop the cultural understanding, attitudes, and communication skills needed to function appropriately within an increasingly global and multicultural working environment.

SLLC 472 International Business Cultures in Engineering and Technology (3 credits)
Restriction: Sophomore standing or higher. Also offered as: ENES472. Credit only granted for: ARHU439B, ARHU439E, ARHU439T, ENES472, SLLC471, SLLC472, or SLLC473. Formerly: ARHU439T.
The goal of this course is to provide students with an understanding of cultural aspects pertaining to global business and engineering, and thereby increasing their awareness of the cultural factors that motivate decisions and behavior in the business world. Students will gain an understanding of how the business cultures in the rest of the world diverge from the American, and develop the cultural understanding, attitudes, and communication skills needed to function appropriately within an increasingly global and multicultural working environment.

SLLC 473 European Business Cultures (3 credits)
Restriction: Sophomore standing or higher. Credit only granted for: ARHU439B, ARHU439E, ARHU439T, ENES472, SLLC471, SLLC472, or SLLC473. Formerly: ARHU439E.
The goal of this course is to provide students with an understanding of cultural aspects pertaining to European business, and thereby increasing their awareness of the cultural factors that motivate decisions and behavior in the European business world. Students will gain an understanding of how the European business cultures diverge from the American, and develop the cultural understanding, attitudes, and communication skills needed to function appropriately within an increasingly global and multicultural working environment.

SLLC 499 Special Topics in World Cultures (3 credits)
Repeatable to 12 credits if content differs.
Interdisciplinary, transnational or cross-language course; specific topic to be announced.

SLLC 601 Teaching Foreign Languages in Higher Education (1 credits)
Restriction: Permission of ARHU-School of Languages, Literatures, and Cultures department. Credit only granted for: SLLC601 or SPAN605. Formerly: SPAN605.
Methods and materials for teaching foreign languages in higher education.

SLLC 698 Special Topics in Interdisciplinary Studies (1-3 credits)
Cross-departmental or cross-programmatic study within the School of Languages, Literatures, and Cultures. Topic to be announced when course is offered.

SLLC 789 Master's Independent Study (1-3 credits)
Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

SLLC 878 Pedagogical Mentoring for Doctoral Students (1 credits)

Prerequisite: SLLC601; and permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 8 credits if content differs.
Pedagogical mentoring by faculty members for doctoral students who have completed their first semester of TA training.

SLLC 889 Doctoral Independent Study (1-3 credits)
Repeatable to 6 credits if content differs.

Sociology (SOCY)

SOCY 401 Intermediate Statistics for Sociologists (4 credits)
Prerequisite: SOCY201; or students who have taken courses with comparable content may contact the department; or permission of BSOS-Sociology department. Restriction: Must not have completed STAT400, BMGT231, or ENEE324.
Issues in the use of significance tests in sociology, one and two-way analysis of variance, elements of multiple regression and correlation, techniques for the analysis of nominal and ordinal data.

SOCY 406 Globalization (3 credits)
Prerequisite: 6 credits in SOCY courses. Credit only granted for: SOCY406 or SOCY498G. Formerly: SOCY498G.
An analysis of the forces driving globalization and its implications for THE SOCIAL WORLD; politics; culture (including American popular culture); technology; the media; the Internet; population flows; environmental changes and problems; other negative (or deviant) flows such as disease, crime and terrorism; inequality, as well as ways of dealing with or resisting globalization (alter-globalization).

SOCY 407 Explaining Social Change: Historical and Comparative Methods (3 credits)
Prerequisite: 6 credits in SOCY courses. Credit only granted for: SOCY407 or SOCY498Y. Formerly: SOCY498Y.
Examines social change from the perspective of comparative and historical sociology to get at the question, 'where are we now?' Students develop a critical appreciation of how scholars construct persuasive explanations for large-scale change focusing on four central questions: the origins of markets and industrial capitalism; the emergence of democracy as opposed to dictatorship; the causes and consequences of social revolution; and the logic of armed conflict. Explanations offered for the changes in question as well as the methods employed are explored. Counterfactual hypotheticals for each central question--that is, what might have been, rather than what historically emerged--are considered.

SOCY 410 Social Demography (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Types of demographic analysis; demographic data; population characteristics; migration; mortality; fertility; population theories; world population growth; population policy.

SOCY 411 Demographic Techniques (3 credits)
Prerequisite: (SOCY201; or students who have taken courses with comparable content may contact the department); and SOCY410. Or permission of BSOS-Sociology department.
Basic techniques for analyzing population structure and demographic processes, including fertility, mortality and migration.

SOCY 412 Family Demography (3 credits)
Prerequisite: 6 credits in SOCY courses. Formerly: SOCY312.
Family and population dynamics. Fertility issues, such as teenage pregnancy, the timing of parenthood, and family size; as they relate to family behavior, such as marital patterns, child care use, and work and the family. Policy issues that relate to demographic changes in the family.

SOCY 413 Sociology of Aging (3 credits)
Prerequisite: 2 courses in SOCY. Credit only granted for: SOCY498D or SOCY413. Formerly: SOCY498D.
The aging of the population is one of the major demographic changes affecting social institutions during the next century. Research demography, sociology, economics, epidemiology, psychology and public health are integrated to develop a broader understanding of the causes and consequences of population aging. A central focus is the diversity of experiences by age, gender, socioeconomic status and health.

SOCY 415 Environmental Sociology (3 credits)
Prerequisite: 6 credits in SOCY courses. Credit only granted for: SOCY498E or SOCY415. Formerly: SOCY498E.
Overview of the field and theoretical themes within the area of environmental sociology and technology. Current issues are explored including: environmental attitudes; environmental movements; environmental justice; globalization; global climate change; and garbage and food.

SOCY 418 Research in Family & Demography (3 credits)
Prerequisite: SOCY202 and SOCY203; and one course in Family and Demography. Repeatable to 6 credits if content differs.
This is a special topics research course for Family and Demography.

SOCY 424 Sociology of Race Relations (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department. Also offered as: AAST424. Credit only granted for: AAST424 or SOCY424.
Analysis of race-related issues, with a primary focus on American society. The historical emergence, development, and institutionalization of racism; the impact of racism on its victims; and racially based conflict.

SOCY 428 Research in Inequality (3 credits)
Prerequisite: SOCY203 and SOCY202; and must have completed a course in Stratification and Inequality. Repeatable to 6 credits if content differs.
This is the special topics research course for Stratification and Inequality.

SOCY 430 Social Structure and Identity (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Theoretical issues in social psychology, focusing on social construction of identity. Identity formation and transformation in social process. Structural and cultural dimensions of social identity.

SOCY 431 Principles of Organizations (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Structural and processual characteristics of organizations that make them effective for different purposes and in different environments. Effects of different institutional environments, small group processes, organizational networks, and leadership. Types of organizations studied include formal bureaucracies, professional organizations, and voluntary associations.

SOCY 432 Social Movements (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Movements that seek change in the social and political structure of society. Origins, tactics, organization, recruitment, and success. Case studies come from such movements as labor, civil rights, student, feminist, environmental, neighborhood, and gay rights.

SOCY 438 Research in Organizations and Institutions (3 credits)
This is the special topics research course for Organizations and Institutions.

SOCY 440 Sociology of the Self-Concept (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
The nature of the self-concept and the social forces that mold it. Major sociological, psychological, and psycho-analytic theories of the self-concept. Self-concept motives, mechanisms of self-defense, and the nature of a healthy self-concept. Empirical research dealing with the bearing of social interaction, social structure, social context and social institutions on the self-concept.

SOCY 441 Social Stratification and Inequality (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department. Restriction: Junior standing or higher.
The sociological study of social class, status, and power. Topics include theories of stratification, correlates of social position, functions and dysfunctions of social inequality, status inconsistency, and social mobility.

SOCY 443 The Family and Society (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Study of the family as a social institution; its biological and cultural foundations, historical development, changing structures and functions, the interaction of marriage and parenthood, disorganizing and reorganizing factors in present-day trends.

SOCY 444 Sociology of Children (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Socio-historical analysis of the changing nature and meaning of childhood. Analysis of social psychological, demographic, and socioeconomic aspects of contemporary children's lives, with a focus on peer groups, gender relations, family change, macroeconomic conditions, poverty, health, and educational well-being of children.

SOCY 448 Research in Social Psychology (3 credits)
This is the special topics research course in Social Psychology

SOCY 450 Measurement of Time, Work, and Leisure (3 credits)
Prerequisite: 6 credits in SOCY courses.
How Americans use time, with specific reference to work, housework, personal and free time activities. Time-use differences across methods, social groups and cultures. Subjective time. Implications for time management, societal quality of life, social policy, and theory.

SOCY 460 Sociology of Work (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Analysis of the American work world with special attention to the impact of social change and occupational conflicts on the individual worker. Professionalization, career patterns, problems of minority groups and the future of work.

SOCY 463 Sociology of Combat (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Sociological theories and concepts related to combat. Influence of historical events on relations between nations and between the military and society. Effects of U.S. social structure on actions in combat; effects of involvement in combat on social structure and on members of society. Cohesion and leadership in military units.

SOCY 464 Military Sociology (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Social change and the growth of military institutions. Complex formal military organizations. Military service as an occupation or profession. The sociology of military life. Relations between military institutions, civilian communities and society.

SOCY 465 The Sociology of War (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
The origin and development of armed forces as institutions, the social causes, operations and results of war as social conflict; the relations of peace and war and revolution in contemporary civilizations.

SOCY 467 Sociology of Education (3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department.
Sociological analysis of educational institutions and their relation to society: goals and functions, the mechanisms of social control, and the impacts of stratification and social change. Study of the school as a formal organization, and the roles and subcultures of teachers and students.

SOCY 498 Selected Topics in Sociology (1-3 credits)
Prerequisite: 6 credits in SOCY courses; or permission of BSOS-Sociology department. Repeatable to 6 credits.
Topics of special interest to advanced undergraduates in sociology. Such courses will be offered in response to student request and faculty interest.

SOCY 601 Statistics For Sociological Research I (3 credits)
Prerequisite: SOCY201; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor. Credit only granted for: SOCY601 and SURV601.
Introductory statistical concepts are covered including descriptive statistics, probability, sampling distributions, expected values, hypothesis testing, tests of significance, measures of association, and if time permits, introduction to regression analysis. Statistical programming software may be used.

SOCY 602 Statistics For Sociological Research II (3 credits)
Prerequisite: SOCY601; or students who have taken courses with comparable content may contact the department. Restriction: Permission of instructor. Credit only granted for: SOCY602 or SURV602.
This course introduces regression analysis using matrix algebra. Topics include bivariate regression, multivariate regression, tests of significance, regression diagnostics, indicator variables, interaction terms, extra sum of squares, and the general linear model. Other topics may be addressed such as logistic regression and path analysis. Statistical programming software may be used.

SOCY 609 Practicum in Social Research (3 credits)
Restriction: Permission of instructor.
The conduct of research in collection and analysis of social science data under the guidance of experienced investigators. Emphasis on a particular research area of procedure, e.g. secondary analysis of survey data; experimental design; evaluation of research; data collection techniques.

SOCY 611 Introduction to Demographic Methods (3 credits)
Survey of standard demographic methods for the description and analysis of population size, structure and composition, including techniques for the analysis of fertility, mortality and migration.

SOCY 618 Computer Methods for Sociologists (3 credits)
Prerequisite: SOCY401; or students who have taken courses with comparable content may contact the department. And must have elementary knowledge of a programming language; or CMSC120; or students who have taken courses with comparable content may contact the department.
Restriction: Permission of instructor.
Designed to present the potential of the computer as a tool in sociological research. Projects involving programming and running of data manipulation techniques, statistical techniques, and simple simulations.

SOCY 620 Development of European and American Sociological Theory (3 credits)
Prerequisite: SOCY203 or SOCY403; or students who have taken courses with comparable content may contact the department; or permission of instructor.
Review of the history of sociological thought with major attention to the key figures (from Marx to C. Wright Mills).

SOCY 621 Contemporary Sociological Theory (3 credits)
Prerequisite: SOCY620, SOCY203, or SOCY403; or permission of instructor.
Review of sociological theory since approximately 1970, with emphasis given to schools of thought (from symbolic interaction to post- modernism) and priciple participants in them (from Goffman to Baudrilliard).

SOCY 622 The Sociology of Knowledge (3 credits)
Analysis of the relation of types of knowledge to social structure. Role of social class and social organization in the development of science, political ideology, belief systems and social values. Social roles associated with production of knowledge.

SOCY 626 Demography of Aging (3 credits)
Examines the demographic foundations of population aging, focusing on macro and historical patterns as well as on trends in mortality health and disability. Also examines the relationship between aging and social institutions such as the family, the economy and public policy.

SOCY 627 Migration (3 credits)
Examines theories of immigration and immigrant adaptation, empirical patterns of migration and immigration, the economic and social effects of immigration, as well as immigration policy issues.

SOCY 630 Population and Society (3 credits)
Selected problems in the field of population; quantitative and qualitative aspects; American and world problems.

SOCY 631 Comparative Sociology (3 credits)
Cross-national analysis of selected social institutions.

SOCY 633 Qualitative Research Methods II, Field Research (3 credits)
Prerequisite: SOCY632; or students who have taken courses with comparable content may contact the department.
As the second course in the qualitative methods sequence, students are expected to have a general knowledge of qualitative methods. Students should have already learned how to collect and analyze qualitative data using interview and ethnographic methods. Student will spend this semester collecting and analyzing qualitative data and must begin the course with a formulated research question, a plan for data collection and sampling. Each student will spend the first two weeks preparing a proposal for submission the the University of Maryland's Institutional Review Board to gain Human Subjects approval to collect data. Then, students will spend a month collecting data, a month analyzing data using QSR NVivo, which will be taught as part of the coursework, and writing up the findings. The end product of the course will be an empirical paper based on the data collected and analyzed throughout the semester.

SOCY 634 Attitudes and Public Opinion (3 credits)
Processes involved in the formation of attitudes; effects of communication; measurement techniques.

SOCY 635 Social Aspects of Fertility (3 credits)
Restriction: Permission of instructor.
Demographic and socioeconomic aspects of fertility behavior; causes and consequences of fertilty decline; relationship between women's status and fertility; determinants of adolescent and nonmarital fertility; differential fertility by race/ethnicity and migration status.

SOCY 637 Demography Of The Labor Force (3 credits)
Restriction: Permission of instructor.
Demographic trends as related to the composition of the U.S. labor force and trends in income; employment status of immigrants, women, and minorities; relationship between skills and jobs; types of data available for study of the labor force.

SOCY 640 Population Policy in Social Context (3 credits)
Credit only granted for: SOCY640 or SOCY731. Formerly: SOCY731.
Both implicit and explicit population policies from an international perspective, and the political and social context in which they occur are examined. Of special interest are the assumptions that underly population policies about the nature of the family and gender relations and the role of ideology in the science-policy nexus.

SOCY 641 Work and Family Policy (3 credits)
This course examines how work policies affect the welfare of employees and their families and how family policies affect work opportunities for family members. The focus is on the U.S. and European countries, and special attention is given to how women, minorities, children, and the elderly fare under certain policies.

SOCY 642 The Sociology of Mental Health (3 credits)
Social factors that influence mental health. Group dynamics of mental health preservation.

SOCY 644 Gender, Work, and Family (3 credits)
The interrelationships among gender, work, and family in contemporary societies. Major research issues addressed from an interdisciplinary and comparative (international) perspective.

SOCY 645 Sociology of the Self Concept (3 credits)
Theory and empirical research dealing with the social determination and social consequences of the self-concept. Sociological, psychological, and psychoanalytic approaches to the self.

SOCY 651 Gender and Development (3 credits)
Restriction: Permission of instructor.
Implications of recent global economic and political transformations for the lives of Third World women and for gender relations; intersection between feminist theory and development theory.

SOCY 653 Family Demography (3 credits)
Restriction: Permission of instructor.
Demograpic perspective on family and household relationships; relationships among economic institutions, family structure, and the content of family life; research from contemporary U.S., historical and cross-cultural sources.

SOCY 660 Theories of Social Psychology (3 credits)
Prerequisite: Must have completed an undergraduate training in sociological research methods, statistics, and theory; or students who have taken courses with comparable content may contact the department.
An introduction to some of the theories in

social psychology that are particularly useful to sociologists. Topics to be covered include theories of cognitive consistency, social exchange, symbolic interaction, role theory, group processes, and collective behavior.

SOCY 661 Social Stratification (3 credits)
Restriction: Permission of instructor.
Major theoretical and research problems in the sociology of social stratification. The characteristics, correlates, and consequences of class and status stratification; the distribution of power; the relationship of social stratification to ideology and the institutional orders of society.

SOCY 664 Armed Forces and Society (3 credits)
Analysis of the relationship between military organization and modern industrial society. Growth and decline of the mass army, the transition from conscription to all-volunteer forces, the social legitimacy of military organization, the military as a form of industrial organization, and problems of civil-military relations in the modern world.

SOCY 671 Sociology of Development (3 credits)
Restriction: Permission of instructor.
Third World development at institutional, organizational, and community levels; factors contributing to success, effectiveness and sustainability of development and to problems and hindrances.

SOCY 699 Special Social Problems (1-16 credits)

SOCY 701 Issues in the Integration of Theory and Method (3 credits)
Prerequisite: Must have attained advanced status in the sociology Ph.D. program; or permission of instructor.
The course is intended solely for advanced doctoral sociology students. The main objective of the course is to develop a dissertation proposal. Consequently, this course may only be taken during or after the semester in which the student completes the specialty (comprehensive) exams.

SOCY 709 Advanced Special Topics in Data Analysis (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive examination of an area of interest in data analysis, including such topics as log linear analysis; discriminant function analysis; canonical correlation; factor analysis; analysis of qualitative data; content analysis; mathematical models.

SOCY 719 Advanced Special Topics in Social Psychology (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive review of an area of current interest in the field, including such topics as social influence; interpersonal attraction; equity theory; the dramaturgical perspective; stress and coping; interpersonal conflict; the social psychology of large organizations.

SOCY 728 Advanced Special Topics in Meta-theory (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive examination of an area of interest in sociological theory, including such topics as paradigm conflicts; philosophy of social science; value issues in sociological theory; formal theory.

SOCY 729 Advanced Special Topics in Substantive Theory (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive examination of an area of interest in theory or a school of sociological theory, including such topics as ethnomethodology; structuralism; Marxism and critical theory; historical study of a major sociological theorist such as Marx, Weber, or Durkheim.

SOCY 739 Advanced Special Topics in Organizations and Occupations (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive review of an area of current interest in the field, including such topics as managing organizational data sets; problems of industrial democracy; quality of work life; innovation and productivity.

SOCY 749 Advanced Special Topics in Demography (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive review of an area of current interest in the field, including such topics as population policy; social and demographic issues in aging; migration; family demography.

SOCY 758 Advanced Special Topics in Sex Roles (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive review of an area of current interest in the field, including such topics as labor force participation; comparative studies; sex roles and aging; gender socialization.

SOCY 759 Advanced Special Topics in Sociology of the Family (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive review of an area of current interest in the field, such as alternative family life styles, cross-cultural and comparative family studies; victimization (sexual and physical abuse).

SOCY 769 Advanced Special Topics in Military Sociology (3 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An intensive review of an area of current interest in the field, including such topics as women in the military; conscription and national service; organizational change in the military; comparative studies of the military.

SOCY 789 Advanced Special Topics in Social Stratification (3 credits)
Restriction: Permission of instructor.
An intensive examination of an area of interest in the field, including such topics as macrostratification; measurement of prestige; institutional variation in status attainment.

SOCY 799 Master's Thesis Research (1-6 credits)

SOCY 819 Research Seminar in Social Psychology (1 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An advanced research seminar for students preparing to do research or take comprehensive examinations in social psychology.

SOCY 829 Research Seminar in Sociological Theory (1 credits)
Restriction: Permission of instructor.
Additional information: May be repeated for credit with permission of instructor.
An advanced research seminar for

students preparing to do research or take comprehensive examinations in sociological theory.

SOCY 839 Research Seminar in Organizations and Occupations (1 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
An advanced research seminar for students preparing to do research or take comprehensive examinations in organizations or occupations.

SOCY 849 Research Seminar in Demography (1 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
An advanced research seminar for students preparing to do research or take comprehensive examinations in demography.

SOCY 858 Research Seminar in Gender, Work and Family (1 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
An advanced research seminar for students preparing to do research or take the specialty examination in Gender, Work and Family.

SOCY 859 Research Seminar in Sociology of the Family (1 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
An advanced research seminar for students preparing to do research or take comprehensive examinations in sociology of the family.

SOCY 869 Research Seminar in Military Sociology (1 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
An advanced research seminar for students preparing to do research or take comprehensive examinations in military sociology.

SOCY 889 Research Seminar in Social Stratification (1 credits)
Restriction: Permission of instructor. Repeatable to 6 credits.
An advanced research seminar for students preparing to do research or take comprehensive examinations in stratification.

SOCY 898 Pre-Candidacy Research (1-8 credits)

SOCY 899 Doctoral Dissertation Research (1-8 credits)

Spanish (SPAN)

SPAN 401 Advanced Composition I (3 credits)
Prerequisite: SPAN302; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Compositions and essays with emphasis on stylistics, idiomatic and syntactic structures. Organization and writing of research papers.

SPAN 402 Advanced Composition II (3 credits)
Prerequisite: SPAN401; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Compositions and essays with emphasis on stylistics, idiomatic and syntactic structures. Organization and writing of research papers.

SPAN 403 Research and Information Sources in Latin American Studies (1 credits)
Corequisite: SPAN458. Recommended: SPAN235 and SPAN234. Restriction: Senior standing. Also offered as: LASC403. Credit only granted for: SPAN403 or LASC403.
A foundational course in Latin American Studies information sources. Students will devise a search strategy and explore reference materials available to the Latin American Studies researcher.

SPAN 404 The Short Story in the Middle Ages (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Presents an overview of one of the most relevant genres of the Middle Ages: the short story, which entailed a process of writing and rewriting of common sources.

SPAN 405 The Sentimental Romance (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Explores Spain's Sentimental Romances in the Late Middle Ages with an interdisciplinary critical approach.

SPAN 406 Don Juan Manuel's Fictional and Historical Prose (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Dedicated to the literary production of an important author: Don Juan Manuel. By examining the interaction among writing, reading and the oral acquisition of knowledge in his works, special attention will be given to how the border between fact and fiction is constructed in the Middle Ages.

SPAN 407 Jews, Moslems, and Christians in Medieval Spain (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Presents an overview of the cultural, political and religious coexistence of Jews, Moslems and Christians in Medieval Spain as it changed from tolerance to persecution and survival.

SPAN 408 Great Themes of the Hispanic Literatures (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Major themes in the literature of Spain or Spanish-America. Each theme will be announced when the course is offered.

SPAN 410 Literature of the Middle Ages I (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Spanish literary history from the eleventh through the fifteenth century. Reading of representative texts. This course covers until the year 1350.

SPAN 411 Literature of the Middle Ages II (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Spanish literary history from the eleventh through the fifteenth century. Reading of representative texts. This course covers from 1350 to 1500.

SPAN 412 Women in the Middle Ages: Myths and Daily Life (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Explores the role of women during the Middle Ages and analyzes the active participation of women in a society in which men's occupation was warfare. Also explores "feminine voices" and female representations in the literature of the times.

SPAN 413 Libro de Buen Amor (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Literary traditions in the Libro de buen amor.

SPAN 414 La Celestina (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Literary and cultural traditions in La Celestina.

SPAN 415 Commercial Spanish II (3 credits)
Prerequisite: SPAN315; or permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Sophomore standing or higher.
Business Spanish terminology, vocabulary and practices. Emphasis on everyday spoken and written Spanish. Readings and discussions of international topics. Cross-cultural considerations relative to international business operations, including exporting and banking.

SPAN 416 Practicum in Translation V (3 credits)
Prerequisite: SPAN357; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Translation of complete literary texts from Spanish into English. Presentation and comparison of special problems encountered in individual projects.

SPAN 417 Practicum in Translation VI (3 credits)
Prerequisite: SPAN416; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Translation of complete literary texts from Spanish into English. Evaluation of different versions of the original. Problems of interpretation, literary structure and analysis.

SPAN 418 Hispanic Literature in Translation (3 credits)
Repeatable to 6 credits if content differs.

SPAN 420 Poetry of the 16th Century (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Selected readings and literary analysis.

SPAN 421 Prose of the 16th Century (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Selected readings and literary analysis.

SPAN 422 Cross-Cultural Communication (3 credits)
Prerequisite: SPAN315. Restriction: Must be in Spanish Language, Literatures, and Cultures program; and junior standing or higher.
Focuses on the relationship of language and culture of those operating in world markets. Particular attention will be given to cross-cultural communication, linguistic systems, and culture specific perceptions of the Hispanic world.

SPAN 424 Drama of the Sixteenth Century (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
From the earliest autos and pasos, the development of Spanish drama anterior to Lope de Vega, including Cervantes.

SPAN 425 Introduction to Hispanic Linguistics I: Basic Concepts (3 credits)
Prerequisite: SPAN301 and SPAN303; or permission of ARHU-School of Languages, Literatures, and Cultures department.
This course begins with an introduction to general concepts in linguistics, from language function and the brain to communication, culture, and thought, and their relation to other disciplines in the social sciences. The main purpose of this course is to provide an overview of Hispanic linguistics through multiple perspectives, while exploring the areas of Spanish morphology, syntax, and semantics. This course will also focus on the structural tendencies of Spanish through a variety of practical activities.

SPAN 426 Introduction to Hispanic Linguistics II: Language in Use (3 credits)
Prerequisite: SPAN425. Also offered as: SPAN626.
Designed for students without previous experience in Linguistics. Focus on language variation and use, linguistic change, and bilingualism.

SPAN 427 Visions and Fictions from Spain (3 credits)
Prerequisite: SPAN331, SPAN332, or SPAN333; or students who have taken courses with comparable content may contact the department; or permission of ARHU-Spanish & Portuguese Languages & Literatures department. Also offered as: FILM427. Credit only granted for: FILM427 or SPAN427.
Overview of Spanish Cinema from the end of the 19th century through present day Spain. Exploration of the production of literary and cinematic texts in their sociohistorical, political, religious and cultural contexts. Taught in Spanish.

SPAN 430 Cervantes: Don Quijote (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.

SPAN 431 Cervantes: Novelas Ejemplares and Entremeses (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.

SPAN 432 Colonial Latin American Literature (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Examines the key themes, writers, literary movements, and cultural debates of the colonial period.

SPAN 433 Women and Culture in Colonial Latin America (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Considers questions of women and historical production, women writers in colonial times, and contemporary literary interpretations of colonial realities. Debates the continued legacy of female archetypes from the colonial period to the present, and epistemological questions regarding the production of knowledge.

SPAN 435 Prose of the 17th Century (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Selected readings, literary analysis, and discussion of the outstanding prose of the period, in the light of the historical background.

SPAN 436 Spanish Baroque Drama (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Reading and critique of the major dramas of the Spanish Golden Age: Lope De Vega, Cervantes, Tirso De Molina and Colderon. Taught in Spanish.

SPAN 437 Drama of the Seventeenth Century (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Drama after Lope de Vega to Calderon de la Barca and the decline of the Spanish theater.

SPAN 438 Special Topics in Colonial Latin America (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Repeatable to 9 credits if content differs.
The conquest and colonization of the New World produced a textual corpus of invaluable importance for the foundation of Spanish American literary tradition. Special topics (themes, authors, debates, etc.) relevant to the Colonial period will be addressed.

SPAN 440 Literature of the Eighteenth Century (3 credits)

Prerequisite: SPAN363, SPAN333, SPAN361, SPAN331, SPAN332, or SPAN362.
Traditionalism, Neo-Classicism, and Pre-Romanticism in prose, poetry, and the theater; esthetics and poetics of the enlightenment.

SPAN 446 Encounters of Atlantic Cultures (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Emphasis will be placed on the Hispanic literature and artistic production resulting from the cultural exchange of the two sides of the Atlantic. Also, examines canonical as well as less known texts from the 16th century to the present with a cross-cultural, transnational and multiethnic lens.

SPAN 448 Special Topics in Latin American Civilization (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Repeatable to 6 credits if content differs.
Intensive independent study of a selected topic related to Latin American civilization.

SPAN 449 Special Topics in Spanish Civilization (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Repeatable to 6 credits if content differs.
An intensive study of a selected topic related to Spanish civilization.

SPAN 450 The Hispanic Caribbean (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Credit only granted for: SPAN408C or SPAN450. Formerly: SPAN408C.
Explores the Hispanic Caribbean as "island spaces" of multiple migrations and cultural identities, as sites of colonial experiences and post-colonial debates.

SPAN 451 Contemporary Cuban Culture, Literature, and Film (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Explores all the phases of the 1959 Cuban Revolution as depicted in the art it produced within the island and in the greater Cuban diaspora.

SPAN 452 The Romantic Movement in Spain (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Poetry, prose and drama of the Romantic and Post-Romantic periods.

SPAN 454 Nineteenth Century Fiction (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Significant novels of the nineteenth century.

SPAN 456 Nineteenth Century Drama and Poetry (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Significant dramas and poetry of the Realist Period.

SPAN 459 Latin American Women Writers (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Repeatable to 9 credits if content differs.
Emphasis will be placed on contemporary Latin American women writers.

SPAN 460 The Generation of 1898 and Its Successors (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Authors and works of all genres of the generation of 1898 and those of the immediately succeeding generation.

SPAN 461 The Generation of 1898 and Its Successors (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Authors and works of all genres of the generation of 1898 and those of the immediately succeeding generation.

SPAN 462 Twentieth Century Drama (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Significant plays of the twentieth century.

SPAN 463 Latin American Drama (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Emphasis will be placed on Latin American plays of the twentieth century.

SPAN 464 Contemporary Spanish Poetry (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Spanish poetry from the generation of 1927 to the present.

SPAN 466 The Contemporary Spanish Novel (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
The novel and the short story from 1940 to the present.

SPAN 467 Latin American Short Story (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
A pivotal genre in modern Latin American literature: The Short Story will be examined.

SPAN 468 Modernism and Post-Modernism in Spain and Spanish-America (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Repeatable to 9 credits if content differs.
A study of the most important works and authors of both movements in Spain and Spanish-America.

SPAN 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

SPAN 470 United States Latino Literature (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Introduction to U.S. Latino literature through exploration of narrative, poetry, and drama by Chicano, Nuyorican, and Cuban American writers. Discussion of socio-historical issues involved in construction of Latino cultural identity in literature.

SPAN 471 United States Latina Fiction (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
An introduction to United States latina fiction through the study of short stories, novels, poetry, etc. It explores strategies of representation by women of color.

SPAN 472 Latin American Perspectives on the United States (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Latin Americans have grappled with the

looming and often conflicting presence of the United States in the Western Hemisphere and as a world power. Latin American discursive responses to the United States will be examined.

SPAN 473 U.S. Latino Performance (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
An introduction to United States Latino Performance texts by Chicano, Nuyorican, Cuban-American, Dominican, Central-American and others.

SPAN 474 Central American Literatures, Cultures, and Histories (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
An overview of Central American history and cultural production, focusing primarily but not exclusively on literary texts.

SPAN 478 Special Topics in United States Latino Cultures (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363. Repeatable to 9 credits if content differs.
Explores special topics in US Latino Cultures, ranging from Chicano, Nuyorican, Cuban-American, Dominican, Central-American and other border cultural identities.

SPAN 479 Honors Thesis (3-6 credits)
Restriction: Must be in Spanish and Portuguese Honors. Repeatable to 6 credits if content differs.
Researching and writing an honors thesis under the direction of a professor.

SPAN 480 Spanish-American Essay (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
A study of the socio-political contents and aesthetic qualities of representative works from the colonial to the contemporary period.

SPAN 481 Spanish American Essay (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
A study of the socio-political contents and aesthetic qualities of representative works from the colonial to the contemporary period, with emphasis on the essay of the twentieth century.

SPAN 488 Spanish-American Fiction (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Representative novels and/or short stories from the Wars of Independence to the present or close analysis of major contemporary works. Subject will be announced each time course is offered.

SPAN 489 Spanish-American Fiction (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Representative novels and/or short stories from the Wars of Independence to the present or close analysis of major contemporary works. Subject will be announced each time course is offered.

SPAN 491 Honors Reading Course: Poetry (3 credits)
Supervised reading to be taken by students admitted to the honors program or upon consultation with the instructor.

SPAN 492 Honors Reading Course (3 credits)
Supervised reading to be taken by students admitted to the honors program or upon consultation with the instructor.

SPAN 493 Honors Reading Course: Drama (3 credits)
Supervised reading to be taken by students admitted to the honors program or upon consultation with the instructor.

SPAN 495 Honors Reading (3 credits)
Prerequisite: Must be in Spanish and Portuguese Honors; or permission of ARHU-School of Languages, Literatures, and Cultures department.
Supervised reading.

SPAN 498 Spanish-American Poetry (3 credits)
Prerequisite: SPAN333, SPAN361, SPAN331, SPAN332, SPAN362, or SPAN363.
Main trends, authors and works from the conquest to Ruben Dario.

SPAN 605 Teaching Spanish I (1 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Must be a Spanish teaching assistant.
Methods and materials for teaching Spanish in higher education.

SPAN 606 Teaching Spanish II (1 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Restriction: Must be a Spanish teaching assistant.
Methods and materials for teaching Spanish in higher education. Continuation of SPAN 605.

SPAN 608 Medieval Spanish Literature (3 credits)
Specific authors, genres, and literary periods studied in depth.

SPAN 609 Medieval Spanish Literature (3 credits)
Specific authors, genres, and literary periods studied in depth.

SPAN 610 The History of the Spanish Language (3 credits)

SPAN 611 Current Trends in Hispanic Applied Linguistics (3 credits)
Restriction: Permission of ARHU-Spanish & Portuguese Languages & Literatures department.
Introduction to current trends in Hispanic Applied Linguistics, emphasizing learning and teaching in Spanish-language contexts.

SPAN 612 Comparative Romance Linguistics (3 credits)

SPAN 613 Bilingualism and Biculturalism in Spanish-Speaking Communities (3 credits)
Restriction: Permission of ARHU-Spanish & Portuguese Languages & Literatures department.
Exploration of Latino bilingual and bicultural communities, Spanglish, language variants, U.S. Latina/o literary and cultural production. Spanish highly recommended.

SPAN 618 Poetry of the Golden Age (3 credits)
Analyses and studies in depth of specific works of specific poets in the sixteenth and seventeenth centuries.

SPAN 619 Poetry of the Golden Age (3 credits)
Analyses and studies in depth of specific works of specific poets in the sixteenth and seventeenth centuries.

SPAN 625 Introduction to Hispanic Linguistics I:Basic Concepts (3 credits)
Introduction to basic terms and definition in Hispanic Linguistics. Fundamental aspects of phonology, morphology, syntax, semantics, sociolinguistics, and pragmatics.

SPAN 626 Hispanic Linguistics II: Language in Use (3 credits)
Prerequisite: SPAN301; or permission of ARHU-School of Languages, Literatures, and Cultures department. Also offered as: SPAN426.
This course will focus on issues related to language variation and use with a more in-depth analysis of the semantics, pragmatics, and sociolinguistics of Spanish. Students will be introduced to current research in the fields of dialectology, bilingualism and language policy, and the social aspects of language change. This course will include an analysis of current research as it relates to the field of linguistics and other social sciences.

SPAN 628 Seminar: the Golden Age in Spanish Literature (3 credits)

SPAN 629 Seminar: the Golden Age in Spanish Literature (3 credits)
Specific authors, genres, literary movements and literary periods of the sixteenth and seventeenth centuries studied in depth.

SPAN 698 Masterpieces of Hispanic Literatures (3 credits)
Repeatable to 6 credits if content differs.
Study of masterpieces of the hispanic literatures, topics, areas of literature and works to vary.

SPAN 699 Independent Study in Spanish (1-3 credits)
Repeatable to 3 credits.
This course is designed to provide graduate students an opportunity to pursue independent study under the supervision of a member of the department.

SPAN 708 The Eighteenth Century (3 credits)
Specific authors, genres, and literary movements studied in depth.

SPAN 718 The Nineteenth Century (3 credits)
Specific authors, genres, and literary movements studied in depth.

SPAN 719 The Nineteenth Century (3 credits)
Specific authors, genres, and literary movements studied in depth.

SPAN 728 The Twentieth Century (3 credits)
Specific authors, genres and literary movements studied in depth.

SPAN 729 The Twentieth Century (3 credits)
Specific authors, genres and literary movements studied in depth.

SPAN 738 The Drama of the Twentieth Century (3 credits)
Specific authors and movements studied in depth.

SPAN 750 Workshop in Essay Writing (3 credits)
Different genres of writing in Spanish including essays, articles, reviews, biographies, etc. Students will analyze models of a genre, produce their own version, edit and revise.

SPAN 788 Seminar Series in Spanish and Latin American Languages, Literatures, and Cultures (1-2 credits)
Prerequisite: Permission of ARHU-School of Languages, Literatures, and Cultures department. Repeatable to 8 credits if content differs.
Topics to be announced when course is offered.

SPAN 798 Open Seminar (3 credits)

SPAN 799 Master's Thesis Research (1-6 credits)

SPAN 808 Colonial Spanish-American Literature (3 credits)
Didactic and narrative prose and epic, dramatic and lyric poetry; principal works and authors.

SPAN 809 Colonial Spanish American Literature (3 credits)
Didactic and narrative prose; dramatic and lyric poetry.

SPAN 818 National Spanish-American Literature (3 credits)
Characteristics of the national literatures. Romantic and Costumbrista literature. Gauchismo and Indigenismo. Principal works and authors.

SPAN 819 National Spanish American Literature (3 credits)
Characteristics of the national literatures. Romantic and Costumbrista literature. Gauchismo and Indigenismo. Principal works and authors.

SPAN 828 Hispanic Poetry of the Nineteenth and Twentieth Centuries (3 credits)
Specific authors, genres and literary movements studied in depth.

SPAN 829 Hispanic Poetry of the Nineteenth and Twentieth Centuries (3 credits)
Specific authors, genres and literary movements studied in depth.

SPAN 898 Pre-Candidacy Research (1-8 credits)

SPAN 899 Doctoral Dissertation Research (1-8 credits)

Public Health (SPHL)

SPHL 400 Introduction to Global Health (3 credits)
Credit only granted for: SPHL400 or SPHL498A. Formerly: SPHL498A.
Exploration of theoretical frameworks and practical perspectives on issues shaping the global health panorama. Determinants examined through: biological and epidemiological; social, cultural and economic; environmental and geographic; multi-section, legal and institutional perspectives with synopsis of how these issues are addressed by international and community organizations in developing countries.

SPHL 488 Children's Health and Development Clinic (1-4 credits)
Prerequisite: Permission of SPHL-School of Public Health.
An opportunity to acquire training and experience in a therapeutically oriented physical education-recreation program for children referred by various education, special education, medical or psychiatric groups.

SPHL 498 Special Topics in Public Health (3 credits)
Restriction: Junior standing or higher. Repeatable to 9 credits if content differs. Credit only granted for: SPHL498 or SPHL698 of same suffix.
Topical and interdisciplinary courses of interest to upper level undergraduate students in the field of Public Health not currently covered by the program.

SPHL 615 Crises of Aging: Time, Retirement and Widowhood (3 credits)
Credit only granted for: HLHP615 or SPHL615. Formerly: HLHP615.
A cross-disciplinary and multidisciplinary investigation of phenomena which comprise a significant portion of the issues confronting an older adult's life: (1) introduction to multiple processes of adulthood and aging; (2) the concepts and meaning of time; (3) pre-retirement and retirement adjustments; and (4) loss and widowhood.

SPHL 625 Issues of Retirement: Theory and Practice (3 credits)
Credit only granted for: HLHP625 or SPHL625. Formerly: HLHP625.
Multidisciplinary examination of retirement phenomena, including theories of transition, government and private sector policies, social expectations, physical correlates, personal adjustments, and economic consequences. Emphasis upon research utilization.

SPHL 689 Selected Problems in Health, Physical Education and Recreation (1-6 credits)
Formerly: HLHP689.
Research projects in special areas in health, physical education and/or recreation which have interdisciplinary implications not covered in structured courses.

SPHL 698 Special Topics in Public Health (3 credits)
Prerequisite: Permission of SPHL-School of Public Health.
Topical and interdisciplinary courses of interest to master and doctoral students in the field of Public Health not currently covered by the program.

SPHL 780 Interdisciplinary Issues in Aging (3 credits)
Credit only granted for: HLHP780 or SPHL780. Formerly: HLHP780.
Multidisciplinary approaches to the processes of aging to achieve a more holistic understanding. Pedagogical research dissemination, peer instruction, guest lecturing, and informal discussion. The demonstration of the multilateral nature of growing older. Discussion of cross-disciplinary and interdisciplinary research proposals.

Statistics and Probability (STAT)

STAT 400 Applied Probability and Statistics I (3 credits)
Prerequisite: Minimum grade of C- in MATH131; or MATH141; or students who have taken courses with comparable content may contact the department. Credit only granted for: BMGT231, ENEE324, or STAT400. Additional information: Not acceptable toward graduate degrees in MATH/STAT/AMSC.
Random variables, standard distributions, moments, law of large numbers and central limit theorem. Sampling methods, estimation of parameters, testing of hypotheses.

STAT 401 Applied Probability and Statistics II (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (STAT400, STAT410). Additional information: Not acceptable toward graduate degrees in MATH/STAT/AMSC.
Point estimation - unbiased and consistent estimators. Interval estimation. Minimum variance and maximum likelihood estimators. Testing of hypotheses. Regression, correlation and analysis of variance. Sampling distributions. Elements of non-parametric methods.

STAT 410 Introduction to Probability Theory (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241). Also offered as: SURV410. Credit only granted for: STAT410 or SURV410.
Probability and its properties. Random variables and distribution functions in one and several dimensions. Moments. Characteristic functions. Limit theorems.

STAT 420 Introduction to Statistics (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (SURV410, STAT410). Also offered as: SURV420. Credit only granted for: STAT420 or SURV420.
Point estimation, sufficiency, completeness, Cramer-Rao inequality, maximum likelihood. Confidence intervals for parameters of normal distribution. Hypothesis testing, most powerful tests, likelihood ratio tests. Chi-square tests, analysis of variance, regression, correlation. Nonparametric methods.

STAT 430 Introduction to Statistical Computing with SAS (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (STAT400, STAT410).
Descriptive and inferential statistics. SAS software: numerical and graphical data summaries; merging, sorting and splitting data sets. Least squares, regression, graphics and informal diagnostics, interpreting results. Categorical data, lifetime data, time series. Applications to engineering, life science, business and social science.

STAT 440 Sampling Theory (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (STAT401, STAT420). Credit only granted for: STAT440 or SURV440.
Simple random sampling. Sampling for proportions. Estimation of sample size. Sampling with varying probabilities. Sampling: stratified, systematic, cluster, double, sequential, incomplete.

STAT 464 Introduction to Biostatistics (3 credits)
Prerequisite: Must have completed one semester of calculus. Restriction: Junior standing or higher. Credit only granted for: BIOE372 or STAT464. Additional information: Not acceptable toward degrees in MATH/STAT.
Probabilistic models. Sampling. Some applications of probability in genetics. Experimental designs. Estimation of effects of treatments. Comparative experiments. Fisher-Irwin test. Wilcoxon tests for paired comparisons.

STAT 470 Actuarial Mathematics (3 credits)
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241). Recommended: STAT400.
Major mathematical ideas involved in calculation of life insurance premiums, including compound interest and present valuation of future income streams; probability distribution and expected values derived from life tables; the interpolation of probability distributions from values estimated at one-year multiples; the 'Law of Large Numbers' describing the regular probabilistic behavior of large populations of independent individuals; and the detailed calculation of expected present values arising in insurance problems.

STAT 498 Selected Topics in Statistics (1-6 credits)
Restriction: Permission of CMNS-Mathematics department. Repeatable to 16 credits.
Topics of special interest to advanced undergraduate students will be offered occasionally under the general guidance of the MATH/STAT major committee. Students register for reading in statistics under this number.

STAT 600 Probability Theory I (3 credits)
Prerequisite: STAT410.
Probability space; distribution functions and densities; Poissson limit theoreom; de Moivre-Laplace theorem; measure-theoretic definition of expectation; classification of measures on R; convergence of random variables; Radon-Nikodym theorem;LP spaces; conditional probabilities; independence of events, sigma-algebras and random variables; Bayes' theo rem; pi-systems and Dynkin systems; discrete Markov chains; random walks; gambler's ruin problem; Markov chains on a general phase space; Borel-cantelli lemmas; Kolmogorov inequality; three series theorem; laws of large numbers.

STAT 601 Probability Theory II (3 credits)
Prerequisite: STAT600.
Weak convergence of measures; characteristic functions; Central Limit Theorem and local limit theorem; stable

laws; Kolmogorov consistency theorem (without proof); conditional expectations and martingales; optimal stopping theorem; convergence of martingales; Brownian motion; Markov processes and families; stochastic integral and Ito formula.

STAT 650 Applied Stochastic Processes (3 credits)

Prerequisite: STAT410; or students who have taken courses with comparable content may contact the department.

Basic concepts of stochastic processes. Markov processes (discrete and continuous parameters), Random walks, Poisson processes, Birth and death processes. Renewal processes and basic limit theorems. Discrete time martingales, stopping times, optional sampling theorem. Applications from theories of stochastic epidemics, survival analysis and others.

STAT 658 Advanced Applied Stochastic Processes II (3 credits)

Prerequisite: STAT650; and must have completed a graduate course in analysis. Or permission of instructor. Recommended: STAT601 and STAT600. Repeatable to 6 credits if content differs.

Advanced topics in applied stochastic processes, rotating among the headings of queueing theory, population proceses, and regenerative phenomena. Course includes disucssion of stochastic models and fields of application, Markov process theory including calculation and characterization of stationary distributions and diffusion approximations, renewal theory and Wiener-Hopf factorization theory.

STAT 689 Research Interactions in Statistics (1-3 credits)

Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

The students participate in a vertically integrated (undergraduate, graduate and/or postdoctoral, faculty) research group. Format varies, but includes regular meetings, readings and presentations of material. See graduate program's online syllabus or contact the graduate program director for more information.

STAT 698 Selected Topics in Probability (1-4 credits)

STAT 700 Mathematical Statistics I (3 credits)

Prerequisite: STAT410; or students who have taken courses with comparable content may contact the department.

Sampling distributions including noncentral chi-squared, t, F. Exponential families, completeness. Sufficiency, factorization, likelihood ratio. Decision theory, Bayesian methods, minimax principle. Point estimation. Lehmann-Scheffe and Cramer-Rao theorems. Set estimation.

STAT 701 Mathematical Statistics II (3 credits)

Prerequisite: STAT700; or students who have taken courses with comparable content may contact the department.

Testing hypotheses: parametric methods. Neyman-Pearson lemma. Uniformly most powerful tests. Unbiased tests. Locally optimal tests. Large sample theory, asymptotically best procedures. Nonparametric methods, Wilcoxon, Fisher-Yates, median tests. Linear models, analysis of variance, regression and correlation. Sequential analysis.

STAT 702 Survival Analysis (3 credits)

Prerequisite: STAT410 and STAT420; or students who have taken courses with comparable content may contact the department; or permission of instructor.

Concepts/definitions of survival functions, hazard rate or hazard function, cumulative hazard functions, mean residual life, inversion formulas; Parametric models: exponential distribution, Weibull distribution; Censored/incomplete data and real data examples; right censored data, doubly censored data, interval censored data, truncated data; Nonparametric maximal likelihood estimator for the lifetime distribution under different types of censoring (e.g., Kaplan-Meier estimator), self-consistency estimators, the EM algorithm, applications of the empirical likelihood; Semiparametric models: accelerated lifetime model, proportional hazard model, the Cox model; Goodness of fit tests and diagnostic methods for model checking.

STAT 705 Computational Statistics (3 credits)

Prerequisite: STAT700 or STAT420. Recommended: Have some programming experience (any language). Credit only granted for: STAT705 or STAT798C. Formerly: STAT798C.

Modern methods of computational statistics and their application to both practical problems and research. S-Plus and SAS programming with emphasis on S-Plus. S-Plus objects and functions, and SAS procedures. Topics include data management and graphics, Monte Carlo and simulation, bootstrapping, numerical optimization in statistics, linear and generalized linear models, nonparametric regression, time series analysis.

STAT 710 Advanced Statistics I (3 credits)

Recommended: STAT600.

Statistical decision theory. Neyman-Pearson lemma and its extensions. Uniformly most powerful test. Monotone likelihood ratio. Exponential families of distributions, concepts of similiarity, and tests with Neyman structure. Unbiased tests and applications to normal families.

STAT 730 Time Series Analysis (3 credits)

Prerequisite: STAT700; and must have completed a graduate course in analysis. Or permission of instructor. Recommended: STAT701 and STAT650.

The methodology of probabilistic description and statistical analysis of (primarily stationary) random sequences and processes. Correlation functions, Gaussian processes, Hilbert-space methods including Wold decomposition and spectral representation, periodogram and estimation of spectral densities, parameter estimation and model identification for ARMA processes, linear filtering, Kalman-Bucy filtering, sampling theorems for continuous-time series, multivariate time series.

STAT 740 Linear Statistical Models I (3 credits)

Prerequisite: STAT700 or STAT420.

Least squares, general linear models, estimability and Gauss-Markov theorem. Simple and multiple linear regression, analysis of residuals and diagnostics, polynomial models, variable selection. Qualitative predictors, one and two way analysis of variance, multiple comparisons, analysis of covariance. Nonlinear least squares. High-level statistical computer software will be used for data analysis throughout the course.

STAT 741 Linear Statistical Models II (3 credits)

Prerequisite: STAT740.

Continuation of STAT 740. Multiway layouts, incomplete designs, Latin squares, complete and fractional factorial designs, crossed and nested models. Balanced random effects models, mixed models, repeated measures.General mixed model, computational algorithms, ML and REML estimates. Generalized linear models, logistic and loglinear regression.

STAT 750 Multivariate Analysis (3 credits)

Prerequisite: STAT700 or STAT420.

Multivariate normal, Wishart's and Hotelling's distributions. Tests of hypotheses, estimation. Generalized distance, discriminant analysis. Regression and correlation. Multivariate analysis of variance; distribution of test criteria. Principal components, canonical correlations and factor analysis.

STAT 770 Analysis of Categorical Data (3 credits)

Prerequisite: STAT430 and STAT420; or permission of CMNS-Mathematics department.

Loglinear and logistic models. Single classification, two-way classification; contingency tables; tests of homogeneity and independence models, measures of association, distribution theory. Bayesian methods. Incomplete contingency tables. Square contingency tables - symmetry. Extensions to higher dimensional contingency tables.

STAT 798 Selected Topics in Statistics (1-4 credits)

STAT 799 Master's Thesis Research (1-6 credits)

STAT 808 Selected Topics in Probability (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

STAT 818 Selected Topics in Statistics (1-3 credits)
Restriction: Permission of instructor. Repeatable to 18 credits.
Advanced topics of current interest.

STAT 898 Pre-Candidacy Research (1-8 credits)

STAT 899 Doctoral Dissertation Research (1-8 credits)

Survey Methodology (SURV)

SURV 400 Fundamentals of Survey Methodology (3 credits)
Prerequisite: STAT100; or permission of BSOS-Joint Program in Survey Methodology department. Credit only granted for: SURV699M or SURV400. Formerly: SURV699M.
Introduces the student to a set of principles of survey design that are the basis of standard practices in the field. The course exposes the student to both observational and experimental methods to test key hypotheses about the nature of human behavior that affect the quality of survey data. It will also present important statistical concepts and techniques in simple design, execution, and estimation, as well as models of behavior describing errors in responding to survey questions. Not acceptable to graduate degrees in Survey Methodology (SURV).

SURV 410 Introduction to Probability Theory (3 credits)
Prerequisite: MATH240 and MATH241; or permission of BSOS-Joint Program in Survey Methodology department. Also offered as: STAT410. Credit only granted for: SURV410 or STAT410.
Probability and its properties. Random variables and distribution functions in one and several dimensions. Moments, characteristic functions, and limit theorems.

SURV 420 Introduction to Statistics (3 credits)
Prerequisite: SURV410 or STAT410. Also offered as: STAT420. Credit only granted for: STAT420 or SURV420.
Mathematical statistics, presenting point estimation, sufficiency, completeness, Cramer-Rao inequality, maximum likelihood, confidence intervals for parameters of normal distributions, chi-square tests, analysis of variance, regression, correlation, and nonparametric methods.

SURV 430 Fundamentals of Questionnaire Design (3 credits)
Restriction: Permission of BSOS-Joint Program in Survey Methodology department. Credit only granted for: SURV430 or SURV630.
Introduction to the scientific literature on the design, testing and evaluation of survey questionnaires, together with hands-on application of the methods discussed in class.

SURV 440 Sampling Theory (3 credits)
Prerequisite: STAT401 or STAT420. Credit only granted for: STAT440 or SURV440.
Simple random sampling, sampling for proportions, estimation of sample size, sampling with varying probabilities of selection, stratification, systematic selection, cluster sampling, double sampling, and sequential sampling.

SURV 615 Statistical Methods I (3 credits)
Prerequisite: Must have completed a two course sequence in probability and statistics; or students who have taken courses with comparable content may contact the department.
First course in a two term sequence in applied statistical methods covering topics such as regression, analysis of variance, categorical data, and survival analysis.

SURV 616 Statistical Methods II (3 credits)
Prerequisite: SURV615.
Builds on the introduction to linear models and data analysis provided in Statistical Methods I. Topics include analysis of longitudinal data and time series, categorical data analysis and contingency tables, logistic regression, log-linear models for counts, statistical methods in epidemiology, and introductory life testing.

SURV 623 Data Collection Methods in Survey Research (3 credits)
Review of alternative data collection methods used in surveys, concentrating on the impact these techniques have on the quality of survey data, including measurement error properties, levels of nonresponse and coverage error. Reviews of the literature on major mode comparisons (face-to-face interviewing, telephone survey and self-administered questionnaires), and alternative collection methods (diaries, administrative records, direct observation, etc.). The statistical and social science literatures on interviewer effects and nonresponse, and current advances in computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI), and other methods such as touchtone data entry (TDE) and voice recognition (VRE).

SURV 625 Applied Sampling (3 credits)
Prerequisite: Must have completed a course in statistics approved by department.
Practical aspects of sample design. Topics include: probability sampling (including simple random, systematic, stratified, clustered, multistage and two-phase sampling methods), sampling with probabilities proportional to size, area sampling, telephone sampling, ratio estimation, sampling error estimation, frame problems, nonresponse, and cost factors.

SURV 630 Questionnaire Design and Evaluation (3 credits)
Credit only granted for: SURV430 and SURV630.
The stages of questionnaire design; developmental interviewing, question writing, question evaluation, pretesting, and questionnaire ordering and formatting. Reviews of the literature on questionnaire construction, the experimental literature on question effects, and the psychological literature on information processing. Examination of the diverse challenges posed by self versus proxy reporting and special attention is paid to the relationship between mode of administration and questionnaire design.

SURV 632 Social and Cognitive Foundations of Survey Measurement (3 credits)
Major sources of survey error-such as reporting errors and nonresponse bias-from the perspective of social and cognitive psychology and related disciplines. Topics: psychology of memory and its bearing on classical survey issues (e.g., underreporting and telescoping); models of language use and their implications for the interpretation and misinterpretation of survey questions; and studies of attitudes, attitude change, and their possible application to increasing response rates and improving the measurement of opinions. Theories and findings from the social and behavioral sciences will be explored.

SURV 640 Survey Practicum I (2 credits)
Restriction: Must be in one of the following programs (Survey Methodology (Doctoral); Survey Methodology (Master's)) ; or permission of instructor. Credit only granted for: SURV620 or SURV640. Formerly: SURV620. Additional information: SURV640 and SURV641 must be taken in consecutive semesters.
First part of an applied workshop in sample survey design, implementation, and analysis. Problems of moving from substantive concepts to questions on a survey questionnaire, designing a sample, pretesting and adminstering the survey.

SURV 641 Survey Practicum II (2 credits)
Prerequisite: SURV620. Restriction: Must be in one of the following programs (Survey Methodology (Doctoral); Survey Methodology (Master's)). Credit only granted for: SURV621 or SURV641. Formerly: SURV621. Additional information: SURV640 and SURV641 must be taken in consecutive semesters.
Second part of applied workshop in sample survey design. Course focus on post data collection process of data processing, editing and anlysis.

SURV 650 Economic Measurement (3 credits)
Prerequisite: Must have completed a course in intermediate microeconomics. Credit only granted for: SURV650 or SURV699L. Formerly: SURV699L.
An introduction to the field of economic measurement. Sound economic data are of critical importance to policymakers, the business community, and others. Emphasis is placed on the economic concepts that underlie key economic statistics and the translation of those concepts into operational measures. Topics addressed include business survey sampling; the creation of business survey sampling frames; the collection of data from businesses; employment and earnings statistics; price statistics; output and productivity measures; the national accounts; and the statistical uses of administrative data. Lectures and course readings assume prior exposure to the tools of economic analysis.

SURV 672 Introduction to the Federal Statistical System and the Survey Research Profession (1 credits)
Credit only granted for: (SURV670 and SURV671) or SURV672. Formerly: SURV670 and SURV671.
The U.S. statistical system and its goals are reviewed. The federal statistical agencies are described, and their primary missions and data collections are examined. The statistical systems of other countries are compared with the U.S. system. Organizational and budgetary aspects are presented. Students will learn about organizations and groups outside of the Federal Statistical System that affect the actions of the System. These include other governmental units, professional associations, and advisory groups created by the agencies themselves. Students will review current laws regarding privacy and confidentiality affecting government agency work and consider a variety of ethical issues confronting government statisticians.

SURV 699 Special Topics in Survey Methodology (1-6 credits)
Prerequisite: Must have completed a graduate-level course in statistics or quantitive methods; and must have familiarity with survey research methods.
Credit according to time scheduled and organization of the course. Organized as a lecture series on specialized advanced topics in survey methodology.

SURV 701 Analysis of Complex Sample Data (3 credits)
Prerequisite: SURV625.
Analysis of data from complex sample designs covers: the development and handling of selection and other compensatory weights; methods for handling missing data; the effect of stratification and clustering on estimation and inference; alternative variance estimation procedures; methods for incorporating weights, stratification and clustering, and imputed values in estimation and inference procedures for complex sample survey data; and generalized design effects and variance functions. Computer software that takes account of complex sample design in estimation.

SURV 720 Total Survey Quality I (2 credits)
Prerequisite: SURV625. Restriction: Permission of instructor. Credit only granted for: (SURV720 and SURV721) or SURV723. Formerly: SURV723.
Total error structure of sample survey data, reviewing current research findings on the magnitudes of different error sources, design features that affect their magnitudes, and interrelationships among the errors. Coverage, nonresponse, sampling, measurement, and postsurvey processing errors. For each error source reviewed, social science theories about its causes and statistical models estimating the error source are described. Empirical studies from the survey methodological literature are reviewed to illustrate the relative magnitudes of error in different designs. Emphasis on aspects of the survey design necessary to estimate different error sources. Relationships to show how attempts to control one error source may increase another source. Attempts to model total survey error will be presented.

SURV 721 Total Survey Quality II (2 credits)
Prerequisite: SURV720. Restriction: Permission of instructor. Credit only granted for: (SURV720 and SURV721) or SURV723. Formerly: SURV723.
Second part of a review of total survey error structure of sample survey data. Reviewing current research findings on the magnitudes of different error sources. Students will continue work on an independent research project which provides empirical investigation of one or more error source. An analysis paper presenting findings of the project will be submitted at the end of the course.

SURV 722 Randomized/Nonrandomized Design (3 credits)
Research designs from which causal inferences are sought. Classical experimental design will be contrasted with quasi-experiments, evaluation studies, and other observational study designs. Emphasis placed on how design features impact the nature of statistical estimation and inference from the designs. Issues of blocking, balancing, repeated measures, control strategies, etc.

SURV 742 Inference from Complex Surveys (3 credits)
Prerequisite: SURV440.
Inference from complex sample survey data covering the theoretical and empirical properties of various variance estimation strategies (e.g., Taylor series approximation, replicated methods, and bootstrap methods for complex sample designs). Incorporation of those methods into inference for complex sample survey data. Variance estimation procedures applied to descriptive estimators and to analysis of categorical data. Generalized variances and design effects presented. Methods of model-based inference for complex sample surveys examined, and results contrasted to the design-based type of inference used as the standard in the course. Real survey data illustrating the methods discussed. Students will learn the use of computer software that takes account of the sample design in estimation.

SURV 744 Topics in Survey Methodology (3 credits)
Prerequisite: SURV440.
Advanced course in survey sampling theory.

SURV 745 Practical Tools for Sampling and Weighting (3 credits)
Prerequisite: SURV615, SURV616, and SURV625; or permission of instructor. Credit only granted for: SURV745 or SURV699E. Formerly: SURV699E.
A statistical methods class appropriate for second year Master's students and PhD students. The course will be a combination of hands-on applications and

general review of the theory behinddifferent approaches to sampling and weighting. Topics covered include sample size calculations using estimation targets based on relative standard error, margin of error, and power requirements. Use of mathematical programming to determine sample sizes needed to achieve estimation goals for a series of subgroups and analysis variables. Resources for designing area probability samples. Methods of sample allocation for multistage samples. Steps in weighting, including computation of base weights, non response adjustments, and uses of auxiliary data. Non response adjustment alternatives, including weighting cell adjustments, formation of cells using regression trees, and propensity score adjustments. Weighting via post stratification, raking, general regression estimation, and other types of calibration.

SURV 746 SURV 746 Advanced Statistical Modeling (3 credits)

Prerequisite: SURV615 and SURV616; or permission of instructor. Credit only granted for: SURV746 or SURV699R. Formerly: SURV699R.

Designed for students on both the social science and statistical tracks for the two programs in survey methodology, will provide students with exposure to applications of more advanced statistical modeling tools for both substantive and methodological investigations that are not fully covered in other MPSM or JPSM courses. Modeling techniques to be covered include multilevel modeling (with an application to methodological studies of interviewer effects), structural equation modeling (with an application of latent class models to methodological studies of measurement error), classification trees (with an application to prediction of response propensity), and alternative models for longitudinal data (with an application to panel survey data from the Health and Retirement Study). Discussions and examples of each modeling technique will be supplemented with methods for appropriately handling complex sample designs when fitting the models. The class will focus on practical applications and software rather than extensive theoretical discussions.

SURV 760 Survey Management (3 credits)

Modern practices in the administration of large scale surveys. Alternative management structures for large field organizations, supervisory and training regimens, handling of turnover, and multiple surveys with the same staff. Practical issues in budgeting of surveys are reviewed with examples from actual surveys. Scheduling of sequential activities in the design, data collection, and processing of data is described.

SURV 772 Survey Design Seminar (3 credits)

Credit only granted for: (SURV770 and SURV771) or SURV772. Formerly: SURV770 and SURV771.

Students present solutions to design issues presented to the seminar. Readings are selected from literatures not treated in other classes and practical consulting problems are addressed.

SURV 798 Advanced Topics in Survey Methodology (3 credits)

Repeatable to 12 credits if content differs. Also offered as: STAT798. Credit only granted for: STAT798 or SURV798.

Individual instruction.

SURV 819 Doctoral Research Seminar in Survey Methodology (1-6 credits)

Restriction: Permission of instructor.

This is the first, two term seminar introducing the doctoral student to areas of integration of social science and statistical science approaches in the design, collection, and analysis of surveys.

SURV 829 Doctoral Research Seminar in Survey Methodology (3-6 credits)

Restriction: Permission of instructor. Repeatable to 6 credits if content differs.

An advanced research seminar for students preparing to do research or take doctoral comprehensive examinations.

SURV 898 Pre-Candidacy Research (1-8 credits)

SURV 899 Doctoral Dissertation Research (1-8 credits)

Theatre, Dance and Performance Studies (TDPS)

TDPS 458 Special Topics in Advanced Performing Arts (1-3 credits)

Prerequisite: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 9 credits if content differs.

Designed for performing arts students. Offers instruction at an advanced level in various aspects of performance such as Voice for the Performing Arts, Movement for the Performing Arts, Acting for the Performing Arts, Partner Dance and a myriad of specific aspects within these genres.

TDPS 469 Advanced Practicum in Stage Management (1-3 credits)

Prerequisite: Minimum of 2 credits from TDPS479. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.

A graded course in stage management for theatre and/or dance productions. A hands-on laboratory experience.

TDPS 470 Production Management (3 credits)

Prerequisite: TDPS201, THET222, THET223, and THET116; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Credit only granted for: TDPS458D or TDPS470. Formerly: TDPS458D.

To familiarize students with techniques and skills required of a Production Manager in a theatrical production. Focus will also be given to the field of event management.

TDPS 479 Production Practicum (1-3 credits)

Prerequisite: TDPS201. Repeatable to 10 credits if content differs. Credit only granted for: TDPS479 or THET479. Formerly: THET479.

A graded course in a specified practical aspect of mounting a theatre or dance production. It is a hands-on, purely laboratory experience.

Theatre (THET)

THET 408 Seminar: Theory and Performance Studies (3 credits)

Repeatable to 6 credits if content differs. Also offered as: THET608. Credit only granted for: THET408 or THET608.

Studies in theatre theory and performance studies from classical antiquity to the present.

THET 410 The American Theatre (3 credits)

Prerequisite: THET488 or THET489; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Restriction: Senior standing. Also offered as: THET610. Credit only granted for: THET410 or THET610.

The American theatre from 1750 to 1950, including the position of theatre in culture, its typical features, and major artists.

THET 411 Voice for the Actor II (3 credits)

Prerequisite: THET324 or THET325; and must audition; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Restriction: Junior standing or higher. Credit only granted for: THET311, THET411, or THET499L. Formerly: THET311.

Learn the International Phonetic Alphabet (IPA) and apply to exploration of sound and language. Designed to increase voice and speech awareness, and create a base knowledge from which to approach any accent or dialect.

THET 420 Language and the Actor (3 credits)
Prerequisite: THET325 or THET324; and must audition; and permission of ARHU-School of Theatre, Dance & Performance Studies department.
Explores the actor's relationship to language, particularly heightened poetic language, in order to: develop the ability to embody language and vocally and physically project the images; apply an intellectual understanding of the inherent structural, poetic, and rhetorical techniques of heightened language in combination with action theory; and access the inner states of character while expressing them through text.

THET 424 Movement II: Advanced Studies in Movement and Mask Theatre (3 credits)
Prerequisite: THET325 or THET324; and must audition; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Restriction: Junior standing or higher.
A deeper exploration of how to use the actor's instrument for dramatic expression. Continuing work in the F.M. Alexander Technique and foundational exercise to help actors learn what they need to prepare for rehearsal and performance. Other techniques may include theatrical styles, physical character, dramatic use and play with space and rhythm and masks.

THET 425 Actor's Process II (3 credits)
Prerequisite: THET325; and must audition; and permission of ARHU-School of Theatre, Dance & Performance Studies department.
A deeper exploration of the work begun in THET325. A continuation of creating a personal process through which the actor can confidently approach any genre of play. Special focus on status and subtext and the world of the playwright.

THET 426 Theatrical Clown (3 credits)
Prerequisite: THET324 or THET325; and must Audition. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Credit only granted for: THET426, THET499C or THET 499O. Formerly: THET499C, THET499O or THET426.
Progression of developing individual clown characters through methods based on European pedagogy which emphasizes a physical and technical approach to actor training.

THET 428 Special Topics in Advanced Theatre and Performance (1-3 credits)
Prerequisite: THET114 or TDPS201; and (THET116, THET222, and THET223); and permission of ARHU-School of Theatre, Dance & Performance Studies department. Restriction: Junior standing or higher. Repeatable to 3 credits if content differs. Additional information: Incorporate the change from THET 114 to TDPS 201, listing both numbers, as students will take the prerequisite under either number. To change the catalog description to reflect the proper unit name as the School of Theatre, Dance, and Performance Studies.
This course is offered as part of the School of Theatre, Dance, and Performance Studies' Artist in Residence program. Topics covered may include: Intercultural Theatre; Performance Art; Puppetry; Solo Performance; or Theatrical Design.

THET 429 Actor's Studio (1-3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
Participation in dramatic roles executed under faculty supervision in the department's productions. Eligible students must make commitments and plan performances with course instructor during pre-registration.

THET 430 Directing II: Working with Actors (3 credits)
Prerequisite: THET330; and (THET324 or THET325); and must Audition; and permission of ARHU-School of Theatre, Dance & Performance Studies department.
Discussion of the preparation procedures and rehearsal practices necessary for the presentation of a variety of theatrical styles and forms. Emphasis on understanding the relationship between the director, the actor, the script and the audience. A series of student directed scenes supplemented by attendance at theatre productions.

THET 435 Advanced Costume Construction (3 credits)
Prerequisite: THET284 and THET384; and portfolio review; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Also offered as: THET635. Credit only granted for: THET435, THET499K, THET635, or THET669K. Formerly: THET499K and THET669K.
The course is taught in a presentation/practical application format. Students will learn advanced techniques in draping and pattern development and develop proficiency in communication of design and construction choices.

THET 440 Advanced Playwriting (3 credits)
Prerequisite: THET340; or permission of instructor. And permission of ARHU-School of Theatre, Dance & Performance Studies department. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Credit only granted for: THET440 or THET499P. Formerly: THET499P.
Ensemble-based writer's workshop. It is the second part of a two-course sequence and is designed for students who already have a foundation in the basics of playwriting or who are other wise well-versed in the art of theatre and dramatic structure. Through exploratory writing sequences, the reading of full-length plays, and in-class readings of work-in-progress, students will continue to deepen their craft and develop the script for a new full-length play.

THET 451 Musical Theatre Workshop I (3 credits)
Prerequisite: Must audition. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Development of the ability to move, act and express through the media of lyric and music.

THET 452 Musical Theatre Workshop II (3 credits)
Prerequisite: Must audition. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Development of the ability to move, act and express through the media of lyric and music from the integrated musicals of the 1960s through the development of concert and rock/pop musicals.

THET 457 Advanced Lighting Technology (3 credits)
Prerequisite: THET377. Restriction: Sophomore standing or higher.
Technological innovations such as moving lights, color changers, and LED are studied from the lighting designer's perspective. Students will have the opportunity to use the equipment in the lighting lab.

THET 464 Design Studio Costume (3 credits)
Prerequisite: THET383; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Credit only granted for: THET464 or THET649.
Intermediate and advanced principles of theatrical costume design rendering skills. Emphasis on development of design concept, unity, character statement, and research. Particular design projects will vary.

THET 465 History of Fashion for the Theatre (3 credits)
Prerequisite: THET116; or permission of instructor. Restriction: Sophomore standing or higher.
A survey of Western clothing from the Ancient Worlds through 20th Century. A discussion of the cultural contexts of various trends in fashion through an examination of art, industry and textiles.

THET 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

THET 470 Advanced Stage Craft (3 credits)
Prerequisite: THET114 or TDPS201; or permission of instructor.
An introduction in technical design and management. Topics include rigging, structural mechanics, and construction in materials other than wood.

THET 471 Design Studio in Scenery (3 credits)
Prerequisite: THET371; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Also offered as: THET639. Credit only granted for: THET471 or THET639.
Advanced study of scenic design for the theatre. Particular design projects will vary.

THET 472 Scene Painting (3 credits)
Prerequisite: THET114 or TDPS201; or permission of ARHU-School of Theatre, Dance & Performance Studies department.
Scene painting techniques and materials. Three-dimensional realistic scenery and non-realistic two-dimensional projects.

THET 473 Rendering for the Theatre II (3 credits)
Prerequisite: THET373; or permission of instructor.
Continued study in rendering techniques and graphic skills for theatrical design presentation. Emphasis on style, technique and use of different artistic media.

THET 474 Advanced Stage Management (3 credits)
Prerequisite: THET114 or TDPS201; and (THET116, THET222, THET223, and THET274); and permission of ARHU-School of Theatre, Dance & Performance Studies department. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department; and sophomore standing or higher.
Intensive practical study of the techniques and procedures for stage management.

THET 475 History of Art, Architecture, and Decor for the Theatre (3 credits)
Prerequisite: THET114 or TDPS201; and (THET116, THET222, and THET223); and permission of ARHU-School of Theatre, Dance & Performance Studies department. Also offered as: THET670. Credit only granted for: THET475 or THET670.
Study of Western art, architecture, and decor and their practical application to theatrical production.

THET 477 Design Studio in Lighting (3 credits)
Prerequisite: THET377; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Also offered as: THET659. Credit only granted for: THET477 or THET659.
Designed for students who have successfully completed THET377 and wish to further develop their lighting design skills. Emphasis is on theoretical design of productions and realized light lab projects. Particular design projects will vary.

THET 479 Production Practicum (1-3 credits)
Prerequisite: THET116 and THET114; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits if content differs.
Designed to expand students' practical knowledge and skills through working on Department of Theatre productions.

THET 480 Audio Technology (3 credits)
Prerequisite: THET114 or TDPS201; or permission of ARHU-School of Theatre, Dance & Performance Studies department.
First technical course in the installation and operation of professional sound systems. This course explores current standards of both analog and digital audio theory as well as recording and reinforcement techniques.

THET 481 Theatre Graphics II: Computer Assisted Design (3 credits)
Prerequisite: THET114 or TDPS201; and THET116; and permission of ARHU-Theatre department. Restriction: Sophomore standing or higher.
Study and practical application of computer generated graphical design for use in theatrical production.

THET 482 Scene Painting II (3 credits)
Prerequisite: THET472; or permission of instructor. Restriction: Sophomore standing or higher.
Advanced study of theatrical scenic painting.

THET 486 History of Modern Theory & Performance (3 credits)
Prerequisite: THET488 or THET489; or permission of instructor. Also offered as: THET686. Credit only granted for: THET486 or THET686.
Modern dramatic and performance theory from realism to the absurd with special emphasis on the European and American avant-garde.

THET 487 Postmodern Theatre and Performance (3 credits)
Prerequisite: THET488 or THET489; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Also offered as: THET687. Credit only granted for: THET487, THET497, or THET687. Formerly: THET497.
American and European experimental performance since 1960 will be explored. Topics include postmodern performance, political performance, pornography and performance, popular culture and performance, and gender and performance. Topics are treated historically and theoretically. Student-produced performance projects are an important component of the seminar.

THET 488 Special Topics in Theatre History Before 1800 (3 credits)
Repeatable to 6 credits if content differs.
Topics in the history of world theatre and performance from the Greeks through 1800.

THET 489 Special Topics in Theatre History from 1800 to Present (3 credits)
Repeatable to 6 credits if content differs.
Topics in the history of world theatre and performance from 1800 to present.

THET 490 History of Theatre I (3 credits)
Prerequisite: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
The history of Western theatre from its origins in classical antiquity through the mid-seventeenth century with emphasis on plays and playwrights, architecture and decor, acting and costuming, and significant personalities. Extensive use of graphic materials, play readings, and production projects.

THET 497 Non-Traditional Theatre (3 credits)

Seminar exploring American and European experimental performance since 1960. Topics include experimental theatre, performance art, pornography and performance, gender and performance, and popular culture and performance. Topics are treated historically and theoretically. Student-produced performance projects are an important component of the seminar.

THET 498 Seminar: Theatre History (3 credits)
Prerequisite: THET488 or THET489. Restriction: Senior standing; and permission of instructor. Repeatable to 6 credits if content differs. Also offered as: THET698. Credit only granted for: THET498 or THET698.
Studies in theatre history from classical antiquity to the present.

THET 499 Independent Study (1-3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
An independent study course in which each student completes an assigned major theatre project under close faculty supervision. Projects may culminate with term papers, scenic or costume designs, or a stage production.

THET 600 Introduction to Graduate Research Methods (3 credits)
Also offered as: THET700. Credit only granted for: THET600 or THET700.
A research and bibliography course with special emphasis on research in theatre. Required of all M.A. and M.F.A. students.

THET 604 History and Theory of Performance (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
The notion of performance as trope, as practice, and now as interdisciplinary field of study is everywhere in critical discourse today. This seminar invites students to explore histories and theories of performance from Aristotle to present day.

THET 606 Teaching Theatre (1 credits)
Strategies and materials for teaching a typical introductory course in theatre, with emphasis on specific problems of classroom instruction (e.g., creating a supportive climate, promoting active learning by students, constructing appropriate tests, adapting methods to content, and resolving discipline problems).

THET 608 Seminar: Theory and Performance Studies (3 credits)
Recommended: THET700 and THET600. Repeatable to 9 credits if content differs. Also offered as: THET408. Credit only granted for: THET408 or THET608.
A repeatable seminar on special topics in theory of the Theatre and Performance Studies.

THET 610 The American Theatre (3 credits)
Recommended: THET600. Also offered as: THET410.
The American theatre from 1750 to 1950, including position of the theatre in the culture, its typical features, and major artists.

THET 614 Ethnography and Performance (3 credits)
Credit only granted for: ANTH688O, THET608E, or THET614. Formerly: THET608E.
Different types of cultural and artistic preformance around the world (theatre, music, dance, sport, festival) are examined. Students learn 1) how various types of live performance are studied ethnographically; 2) what thick description reveals and how it adds to the analysis of performance; and 3) methods for conducting an ethnographic study of performance.

THET 616 Character Development (2-3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
European-based pedagogy which emphasizes a physical and technical approach to actor training. Includes technique training in physical theatre and movement, voice, monologue writing, site-specific performance, and street theatre.

THET 617 Performance Internship (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students design a one-semester internship in an area of interest in professional theatre. The internship will be in collaboration with one of the Department's partner theatre companies, or with another regional professional theatre. Students will complete a written self-assessment as well as an exit interview with their on-site supervisor.

THET 619 Special Topics in Performance Studio (2-6 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
This is a rotating "special topics" course that will address the history and theory of performance in areas including: political performance, experimental theatre, and contemporary theatre. The course will be offered by guest artists/instructors who are part of the Theatre Department's professional network of scholars and artists.

THET 620 Performance Studio 1 (6 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students will develop a common performance vocabulary examining the basic elements of the craft of acting and vocal training.

THET 621 Performance Studio 2 (6 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Focus is placed on plays by contemporary playwrights and movement training based on the theories of F.M. Alexander, Michael Chekhov, Jerzy Grotowski, and Jacques Lecoq. The work will include jeu, neutral mask, and psychological gesture.

THET 622 Performance Studio: Classical Technique (6 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students will learn how to perform heightened language texts of global literature, including the Greeks, Moliere, the Jacobeans, Shakespeare, and works of African, Asian, or Hispanic origin.

THET 623 Period Movement and Verse Analysis (6 credits)
Emphasizes movement skills related to specific theatrical styles (such as the movement of a Greek chorus in classical drama), and will include period movement, commedia dell arte, clown, and buffoon. The voice training will focus on developing singing technique, as well as accents, dialects, and dialect research.

THET 627 Verse Analysis (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Exploration of how verse works. Looking at objective issues of verse speaking iambic pentameter and its variations, heightened versus naturalistic speech, antithesis, onomatopoeia, assonance, alliteration, and the difference between verse and prose as well as irony, ambiguity, passion, coolness, exploring character, poetry and hidden poetry.

THET 629 Performance Lab (1 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students will develop a performance project based on the training that they have received in their current semester's

study. This course offers students the oportunity to expand and develop their practice.

THET 630 Voice I (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students will learn the Linklater progression of voice exercises. Work will include the discovery of sound in the body, awareness and opening of the channel, exploration of resonance, vocal freedom and range, isolating and strengthening resonating chambers and articulation exercises.

THET 632 Playwriting (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Lessons in playwriting, including character, plot, dramatic structure, dialogue, exposition, setting, and creating theatrical images.

THET 635 Advanced Costume Construction (3 credits)
Prerequisite: THET284 and THET384; and portfolio review; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Also offered as: THET435. Credit only granted for: THET435, THET499K, THET635 or THET669K. Formerly: THET499K and THET669K.
The course is taught in a presentation/practical application format. Students will learn advanced techniques in draping and pattern development and develop proficiency in communication of design and construction choices.

THET 637 Movement Awareness (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Based on the F.M. Alexander Technique, students will learn to recognize habit patterns that interfere with movement, breath, voice, and expression.

THET 639 Advanced Design Studio in Scenery (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 12 credits if content differs. Also offered as: THET471. Credit only granted for: THET471 or THET639.
A repeatable course that allows students to progress in their design training through a series of carefully and individually structured assignments and projects.

THET 640 Voice II (2 credits)
Prerequisite: THET630. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Build on an understanding of vocal anatomy and knowledge of habitual vocal usage, this course will challenge students to work beyond their habitual voice patterns. Emphasis will be placed on range, resonance, and vocal improvisation.

THET 641 Solo Performance (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students will study both the history and contemporary practice of creating solo performances. A guest artist (a theatre professional drawn from the Department's professional network) will teach this course.

THET 642 Thesis Development (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Focus on writing the scripts for the thesis projects that will be performed in year three in the Festival of New Works. The course is designed to compose and finish a story in the form of a play or devised script during the course of the semester. Students will hone skills of listening and critique, and to provide a forum in which you can share and garner feedback on your work.

THET 643 Puppetry and Performance (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Students will learn the history and techniques of puppetry (Western and Non-Western).

THET 647 Movement Fundamentals (2 credits)
Prerequisite: THET637. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Based on Jacques Lecoq's technique of neutral mask and character mask.

THET 648 Performance Practicum (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 6 credits.
A "hands-on" course providing students with opportunities to apply techniques, concepts, and principles learned in class to practical production projects in real time situations. Generally, practicum students will participate in a Main-stage production.

THET 649 Advanced Design Studio in Costume (3 credits)
Repeatable to 12 credits if content differs. Credit only granted for: THET483 or THET649.
A series of carefully and individually structured assignments and projects that allows students to progress in their design training.

THET 650 Voice III (2 credits)
Prerequisite: THET640. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Deepening understanding and experience of the unique voice. Work will focus on identifying vocal habits, and then learning new tools such as the International Phonetic Alphabet, phrasing distinctions, and Roy Hart vocal techniques.

THET 652 Ensemble Devised Performance (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Process of developing an ensemble, and as an ensemble researching, developing and performing a devised performance. The techniques involve teaching how each solo voice must be developed in order for the ensemble voice to function efficiently.

THET 657 Movement Styles (2 credits)
Prerequisite: THET637. Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Based on the techniques of theatrical clown originally developed by Jacques Lecoq and further developed by Serge Martin, Phillipe Gaulier and Pierre Byland. Builds from the techniques learned with neutral and character mask work. Theatrical clown work increases a performer's flexibility, ability to pick up cues, enhances stage presence, and teaches the performer to work beyond the fourth wall.

THET 659 Advanced Design Studio in Lighting (3 credits)
Restriction: Must not have completed THET477; and permission of ARHU-School of Theatre, Dance & Performance Studies department. Repeatable to 12 credits if content differs. Also offered as: THET477. Credit only granted for: THET477 or THET659.
A repeatable course that allows students to progress in their design training through a series of carefully and individually structured assignments and projects.

THET 669 Independent Study (1-3 credits)

THET 670 Period Style for the Theatre: Fashion and Decor (3 credits)
Recommended: THET600. Also offered

as: THET475. Credit only granted for: THET475 or THET670.
A study of environmental decor, theatrical architecture, historic ornament and fashion through the ages and their practical application for theatrical production.

THET 672 Theory of Visual Design in Scenery (3 credits)
A historical and theoretical study of design practices in performing arts with an emphasis in scene design and interpretation.

THET 675 Theory of Visual Design in Lighting (3 credits)
A historical and theoretical study of design practices in performing arts with an emphasis in lighting design and interpretation.

THET 677 Production Practices (2 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
Explores business practices in the field of professional theatre, including arts management, development, and marketing.

THET 678 Theory of Visual Design For the Performing Arts (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
A historical and theoretical study of design practices in the performing arts.

THET 685 History of Theatrical Theory Before Modernism (3 credits)
Recommended: THET600.
Theories of drama (written script) and theatre (performance) from fifth-century B.C. Greece through nineteenth-century romanticism.

THET 686 History of Modern Theory (3 credits)
Recommended: THET600. Also offered as: THET486. Formerly: THET689.
Modern dramatic and performance theory from realism through postmodernism with special emphasis on the European and American avant-garde.

THET 687 History of Performance Theory: 1960 to the Present (3 credits)
Recommended: THET700 or THET600. Also offered as: THET487.
The third in a sequence of seminars on the history of dramatic and performance theory. Focusing primarily on the European and American avant-gardes, this course examines the development of performance theory and practice from the Absurd to the present.

THET 688 Special Problems in Drama (3 credits)
The preparation of adaptations and other projects in dramaturgy.

THET 697 Performance Thesis Project (3 credits)
Restriction: Permission of ARHU-School of Theatre, Dance & Performance Studies department.
The thesis project incorporates both a performance and an oral examination that assesses the student's ability to apply techniques and methods learned thoughout his/her course of study. Students will select a performance project based on their areas of expertise or interest. Performances will be videotaped and reviewed by the student's thesis committee.

THET 698 Seminar: Theatre History (3 credits)
Prerequisite: THET491 and THET490; or students who have taken courses with comparable content may contact the department. Recommended: THET600. Repeatable to 9 credits if content differs. Also offered as: THET498.
Studies in theatre history from classical antiquity to the present.

THET 700 Introduction to Doctoral Studies in Theatre (3 credits)
Prerequisite: Must be admitted to the Ph.D. program in Theatre. Also offered as: THET600. Credit only granted for: THET600 or THET700.
Basic skills in theatre research.

THET 711 Critical Theory (3 credits)
Prerequisite: THET700.
Recommended: THET712.
A doctoral methods course. Major developments in modern and postmodern critical theory with particular emphasis on application to the fields of Theatre and Performance Studies.

THET 712 Historical Research Methods and Historiography in Theatre (3 credits)
Prerequisite: THET700. Formerly: PCOM712.
A survey of methods commonly used in writing theatre history and their application to a suitable problem. Formulation of significant research questions, systematic collection of bibliographic and phenomenal information, formulating substantial claims, organizing and writing research for disciplinary outlets.

THET 713 Performance Studies (3 credits)
Prerequisite: THET700.
Introduces doctoral students to theoretical and methodological issues in performance studies. We will focus on 3 primary areas of research, analyzing representational strategies of adaptations, ethnography, and cultural analysis of theatrical performance.

THET 788 Master's Tutorial (1-6 credits)
Restriction: Permission of instructor.
Collaboration with a faculty member on joint creative and artistic projects.

THET 789 Master's Practicum (1-6 credits)
Restriction: Permission of instructor.
Participation in creative and artistic activities with professional level theatrical organizations.

THET 799 Master's Thesis Research (1-6 credits)

THET 888 Doctoral Practicum in Theatre (3-9 credits)
Repeatable to 9 credits if content differs. Formerly: PCOM888.
Critical analysis of a phase of a professional field of theatre. Analysis of professional activity through personal observation. Evaluation of the purpose, process, effectiveness, and efficiency of professional activity. Recommendations for training and further research.

THET 889 Doctoral Tutorial in Theatre (3-8 credits)
Repeatable to 9 credits if content differs. Formerly: PCOM889.
Individual research in theatre.

THET 898 Pre-Candidacy Research (1-8 credits)

THET 899 Doctoral Dissertation Research (1-10 credits)
Formerly: PCOM899.

Toxicology (TOXI)

TOXI 609 Methods in Toxicology (1-3 credits)
Restriction: Permission of CMNS-Chemical & Life Sciences department.
Repeatable to 6 credits.
Provides the opportunity for graduate students to become familiar with laboratory methods used by the staff to study the effect of toxins and environmental pollutants on living systems. Permission and credit arranged individually.

TOXI 799 Masters Thesis Research (1-6 credits)
Restriction: Permission of CMNS-Chemical & Life Sciences department.

TOXI 898 Pre-Candidacy Research (1-8 credits)

TOXI 899 Doctoral Dissertation Research (1-8 credits)
Restriction: Permission of CMNS-Chemical & Life Sciences department.

Maryland English Institute (UMEI)

UMEI 001 English as a Foreign Language: Beginning (12 credits)
Restriction: Permission of EDUC-Dean-Maryland English Institute department.
Intensive course for the non-native speaker of English who has little or no previous knowledge of English. Focus on the rapid acquisition of the basic features of English grammar and pronunciation and on speaking and understanding American English; reading and writing appropriate to the level will be included. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 002 English as a Foreign Language: Intermediate I (12 credits)
Restriction: Permission of EDUC-Dean-Maryland English Institute department.
Intensive course for the non-native speaker of English who has had some previous instruction in English. Emphasis on improving listening and speaking skills, on mastering intermediate grammatical structures, and on expanding vocabulary. Includes practice in reading and writing appropriate to the level. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 003 English as a Foreign Language: Intermediate II (12 credits)
Restriction: Permission of EDUC-Dean-Maryland English Institute department.
Intensive course for the non-native speaker of English who has mastered the essential structures of English grammar. Emphasis on improving communicative skills for a wide range of linguistic situations, on rapid expansion of vocabulary, and on improving reading comprehension and basic writing skills. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 004 English as a Foreign Language: Intermediate III (12 credits)
Restriction: Permission of EDUC-Dean-Maryland English Institute department.
Intensive course for the non-native speaker of English who has a good command of the basic features of spoken and written English. Emphasis on refining speaking and listening skills, on improving reading speed and comprehension of academic texts, and on developing writing skills for academic courses. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 005 Advanced English as a Foreign Language (6 credits)
Semi-intensive course for the nearly proficient non-native speaker of English needing additional language instruction prior to undertaking full-time academic study. Speaking and listening skills; improvement of reading speed and comprehension; and development of writing skills. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 006 English Pronunciation (2 credits)
Restriction: Must have graduate standing; and permission of EDUC-Dean-Maryland English Institute department.
Individualized class for the non-native speaker of English. Diagnosis of individual pronunciation problems. Practice in the correct pronunciation of English sounds and improvement of ability to speak English with proper stress and intonation patterns. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 007 Advanced Writing for International Students (3 credits)
Restriction: Must have graduate standing.
A writing skills course for the non-native speaker of English with a good command of spoken English. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 008 Advanced Oral Communication Skills (2 credits)
Restriction: Must have graduate standing; and permission of EDUC-Dean-Maryland English Institute department.
For advanced non-native speakers of English. Practice in speaking skills relevant to the academic situation. Improvement of speaking skills for various classroom activities such as participating in discussions, making appointments with professors, asking for information and presenting oral reports. Special fee required for this course. This course does not carry credit towards any degree at the University and does not count in the retention plan.

UMEI 011 Integrated English: Elementary (5 credits)
Prerequisite: Placement exam; and permission of EDUC-Dean-Maryland English Institute department.
English as a Second Language course for students at the elementary level.

UMEI 012 Integrated English: Intermediate (5 credits)
Prerequisite: Placement exam; and permission of EDUC-Dean-Maryland English Institute department.
English as a Second Language course for students at the intermediate level.

UMEI 013 Integrated English: Advanced (5 credits)
Prerequisite: Placement exam; and permission of EDUC-Dean-Maryland English Institute department.
English as a Second Language for students at the advanced level.

UMEI 028 Special Topics in English as a Second Language (1 credits)
Repeatable to 18 credits if content differs.
Focuses on particular English language topics for ESL student as indicated by title. Course intended to be taken concurrently with UMEI011, UMEI012, or UMEI013; but may be taken independently with special permission.

University/World Courses (UNIV)

UNIV 798 Special Topics Colloquium on University Teaching and Learning (1-3 credits)
Restriction: Permission of UGST-Undergraduate Studies. Repeatable to 6 credits if content differs.
Special topic courses directed at experienced graduate teaching assistants who are interested in university teaching and learning issues. Can be used by students for participation in the Universtiy Teaching and Learning Program.

Urban Studies and Planning (URSP)

URSP 488 Selected Topics in Urban Studies and Planning (1-3

credits)
Prerequisite: Permission of ARCH-Urban Studies & Planning Program department. Repeatable to 6 credits if content differs.
Topics of special interest to advanced urban studies students.

URSP 600 Research Design and Application (3 credits)
Formerly: URSP602.
Techniques in urban research, policy analysis, and planning. Survey of descriptive and normative models. Objective and subjective measurements. Emphasis on assumptions of research.

URSP 601 Research Methods (3 credits)
Recommended: URSP600; and an undergraduate-level statistics course; and familiarity with Microsoft Excel. Formerly: URBS601.
Use of measurement, statistics, quantitative analysis, and micro-computers in urban studies and planning.

URSP 603 Land Use Planning: Concepts and Techniques (3 credits)
Credit only granted for: URSP603, URBS680, or URBS603. Formerly: URBS603.
Basic techniques for regulating the use and appearance of land. Legal framework, social implications, planning approaches, communicating land use information.

URSP 604 The Planning Process (3 credits)
Credit only granted for: URSP604, URBS656, or URBS604. Formerly: URBS604.
Problem formulation, goal setting, generating and evaluating alternatives, budgeting, implementation. Working with committees and communities, conducting meetings, making decisions, and making presentations.

URSP 605 Planning History and Theory (3 credits)
Exploration of the major events and issues in United States planning history, the prevailing theories of planning, and the planning history-theory relationship. Emphasis on urban planning.

URSP 606 Microeconomics of Planning and Public Policy (3 credits)
Restriction: Must not have completed URSP630. Credit only granted for: URSP606, URBS606, or URBS630. Formerly: URBS606.
Resource allocation in a market economy, the nature of market failures, and the justifications for public sector intervention. The limits and possibilities for planning in a market economy.

URSP 607 Human Behavior and the Physical Environments (3 credits)
Recommended: URSP603. Formerly: URBS607.
Theories and research about ways human-produced environments change and are changed by the behavior of individuals and groups.

URSP 612 Geographic Information Systems for Urban Planning (3 credits)
Credit only granted for: URSP612 or URSP688M. Formerly: URSP688M.
An introduction to GIS and its application to urban planning. Topics include: thematic mapping, GIS data structure, spatial analysis, Internet GIS, using census data to study urban areas, and examples of urban GIS application. Weekly laboratory and project work use ArcGIS software.

URSP 631 Transportation and Land Use (3 credits)
Credit only granted for: URSP631 or URSP688L. Formerly: URSP688L.
The interrelationship between transportation and land use. What are the impacts of various transportation modes on land use patterns, and how can land use solutions influence travel demand. The integration of transportation into master planning and site impact analysis. Using quantitative methods to understand the land use and transportation linkage.

URSP 632 The Urban Neighborhood (3 credits)
Formerly: URBS632.
Urban neighborhoods as physical, socio-political and geographic entities. Residents' perceptions, urban/suburban differences, neighboring behavior, organization, planning, design concepts.

URSP 640 Growth Management and Environmental Planning (3 credits)
Topics associated with growth management, defined as policies and strategies by which governments attempted to control the amount, location, pace, pattern and quality of development within their jurisdictions.

URSP 660 Function and Structure of Metropolitan Areas (3 credits)
Formerly: URBS660.
Theoretical and historical examination of basic urban functions. Intra-metropolitan location of activities. Role of metropolitan planning in a market economy. Examination of cases of metropolitan planning to assess alternative strategies for future metropolitan development.

URSP 661 City and Regional Economic Development Planning (3 credits)
Prerequisite: URSP606 or URSP660. Credit only granted for: URSP661, URBS440, or URBS661. Formerly: URBS661.
Spatial patterns of employment and populations, and models of urban and regional growth and decline. Focus on application of economic theory and urban planning techniques to issues of local economic development and planning.

URSP 662 Urban and Regional Planning in Developing Countries (3 credits)
Theoretical exploration of urban and regional change drawing upon international planning and social science literature, and case-study analysis of multiple challenges and opportunities facing planners and policy-makers in the urban-centered areas of less-developed countries.

URSP 664 Real Estate Development for Planners (3 credits)
Prerequisite: URSP606. Credit only granted for: URSP664 or URSP688F. Formerly: URSP688F.
Planning, Architectural and Public Policy students are introduced to the real estate development process primarily from the point of view of the private entrepreneurial developer. It will include the steps in undertaking a real estate development from the initial concept to the property management and final disposition, the basic financial and tax concepts underlying real estate development, a review of national housing policy,including public-private partnerships, and solving specific real estate development problems using financial spread-sheets.

URSP 671 Politics and Planning (3 credits)
Formerly: URSP691.
Examination of the practice of planning as a technical and a practice role. Attitudes of planners toward plan implementation. Development of effective roles for professional planners.

URSP 673 Social Planning (3 credits)
Credit only granted for: URSP673, URBS683, or URBS673. Formerly: URBS673.
Planning programs and policies in health, education, and social welfare. Strategies for organizational and community change and development.

URSP 681 Urban Planning Law (3 credits)
Credit only granted for: URSP681, URBS450, or URBS681. Formerly: URBS681.

Survey of the urban legal environment. Issues of planning, zoning, eminent domain, land use controls, housing codes, historic preservation and related tax provisions.

URSP 688 Recent Developments in Urban Studies (2-6 credits)

Formerly: URBS688.
Examination of selected current aspects of urban affairs and planning, including, for example, <"new towns"> in the United States or neighborhood preservation in Russia. Location of course may be off-campus.

URSP 705 Summer Community Planning Studio I (4 credits)

Restriction: Permission of instructor.
Intensive community planning group field work, typically five days a week for four weeks. Often outside the USA. Application of class work to actual planning and policy challenges. Students seeking to meet the URSP studio requirement must also take URSP 706.

URSP 706 Summer Community Planning Studio II (2 credits)

Restriction: Permission of instructor.
Intensive analysis and report-preparation of work completed in URSP 705. Held in College Park. Students seeking to meet the URSP studio requirement must also take URSP 705.

URSP 708 Community Planning Studio (2-6 credits)

Prerequisite: URSP605, URSP604, URSP601, and URSP600; and permission of ARCH-Urban Studies & Planning Program department. Repeatable to 6 credits. Credit only granted for: URSP704 or URSP708. Formerly: URSP704.
The Community Planning Studio is a "capstone" course intended to provide students with an opportunity to apply their knowledge and skills to analyze current, pressing planning issues, in a selected community and to produce a report containing recommendations for addressing those issues. In essence, students act as a consulting team for a community client.

URSP 709 Field Instruction (3-6 credits)

Prerequisite: URSP605, URSP604, and URSP600; or permission of ARCH-Urban Studies & Planning Program department. Repeatable to 6 credits. Credit only granted for: URSP703 or URSP709. Formerly: URSP703.
Students will satisfy a 300-hour internship (20 hours for 15 weeks during the spring, 25 hours a week for 12 weeks during the summer). Suitable internships are approved by the Internship Coordinator or Instructor; they involve a significant amount of planning work (preferably in the student's are of interest) and provide an appropriate on-site supervisor. The Internship Coordinator will assist students in finding a suitable internship, but the ultimate responsibility rests with each student. Whether the internship is paid or not is a matter to be worked out between the student and the organization.

URSP 710 Research Seminar: Urban Theory and Issues (3 credits)

Prerequisite: 15 credits in URSP courses. Restriction: Must be in Urban and Regional Planning and Design (Doctoral) program. Formerly: URBS710.
An advanced research seminar for M.A. and M.C.P. students preparing their final research projects.

URSP 788 Independent Study in Urban Studies and Planning (1-3 credits)

Repeatable to 6 credits if content differs. Formerly: URBS788.
Directed research and study of selected aspects of urban affairs.

URSP 798 Readings in Urban Studies and Planning (1-3 credits)

Repeatable to 6 credits if content differs. Formerly: URBS798.
Directed readings in selected aspects of urban affairs and planning.

URSP 799 Master's Thesis Research (1-6 credits)

Formerly: URBS799.

URSP 804 Advanced Planning Theory (3 credits)

Relations between theory and practice in planning. Ways of developing and using knowledge in collective action. Challenges to organizing for planning, finding knowledge useful for planning and balancing social attachments with free inquiry.

URSP 805 Seminar in Research Design (3 credits)

Prerequisite: URSP804 and URSP810.
Addresses fundamental aspects of research desing for Ph.D students in urban planning and policy-related fields. Topics include principles of research design, formulating a feasible hypothesis and identifying appropriate methodology for testing hypotheses eg. qualitative methods, quantitative methods, survey research. Writing of proposals and dissertation. Publication, presentation, and funding.

URSP 810 Contemporary Metropolitan Issues (3 credits)

Restriction: Must be in Urban and Regional Planning and Design (Doctoral) program.
Introduces Ph.D. students to current metropolitan issues. Focus is on the historical development of the issue, problem definition, methodological approaches to its study, methodological dilemmas, and the ways that different conclusions are translated into policy. Topics vary from semester to semester but include such topics as the spatial mismatch hpothesis, the impact of urban design and form on travel behavior, the impact of technology on urban form, the justification for historic preservation, and sustainable development.

URSP 898 Pre-Candidacy Research (1-8 credits)

Repeatable to 6 credits if content differs.
Selected topics in Urban Studies and Planning. Topics will vary with the instructor.

URSP 899 Doctoral Dissertation Research (1-8 credits)

This course is a required course for the Ph.D program in Urban and Regional Planning and Design.

Latina/o Studies (USLT)

USLT 488 US Latina/o Senior Seminar (3 credits)

Recommended: USLT202 or USLT201. Restriction: Senior standing; and permission of instructor. Repeatable to 9 credits if content differs.
A variable topics seminar that exposes students to interdisciplinary critical readings, writings, and research in U.S. Latina/o Studies. Interdisciplinary research methodologies are broadly addressed. Students will gain skills and practice in reading critical analytic texts and will develop writing skills.

USLT 498 US Latina/o Studies: Special Topics (3 credits)

Prerequisite: USLT202 or USLT201. Restriction: Junior standing or higher. Repeatable to 9 credits if content differs.
Specific content to be announced when courses are offered.

Veterinary Medicine (VMED)

VMED 688 Special Topics in Veterinary Medical Sciences (1-4 credits)

Prerequisite: Permission of AGNR-Veterinary Medicine Program department. Repeatable to 8 credits if content differs.

Lectures and discussions on current topics in veterinary medicine such as animal disease surveillance, risk analysis, molecular epidemiology, or fish pathology. Targeted at veterinary medicine (DVM) students and other graduate students with a background in veterinary medical sciences.

VMED 698 Seminar in Veterinary Medical Sciences (1-3 credits)
Prerequisite: Permission of AGNR-Veterinary Medicine Program department. Repeatable to 6 credits if content differs.
Presentation and discussion of scientific publications, current topics and new methodologies related to veterinary medical sciences.

VMED 699 Special Problems in Veterinary Medical Sciences (1-4 credits)
Prerequisite: Permission of faculty mentor. Repeatable to 8 credits if content differs.
Independent study of a specific problem related to veterinary medicine such as a disease outbreak, application of a new diagnostic test or a risk analysis related to animal health. Targeted at veterinary medicine (DVM) students and other graduate students with a background in veterinary medicine.

VMED 799 Thesis Research (1-6 credits)
Repeatable to 99 credits if content differs.

VMED 899 Dissertation Research (1-8 credits)
Repeatable to 99 credits if content differs.

Veterinary Medical Sciences (VMSC)

VMSC 600 Infectious Disease Diagnosis and Interpretation (1 credits)
A broad exposure to many different diagnostic techniques, the appropriate use of the tests, how they are to be interpreted and the possible consequences of the diagnosis.

VMSC 610 Recombinant Viral Vectors (3 credits)
Restriction: Permission of instructor.
A comprehensive presentation of information on the molecular biology of the most relevent viral vectors developed to date and give insight on vector contruction, purification and utilization. Also intended for students in virology and related fields as well as to those interested in the application of viral vectors to basic research.

VMSC 688 Special Topics in Veterinary Medical Sciences (1-4 credits)
Prerequisite: Permission of AGNR-Veterinary Medicine Program department. Repeatable to 8 credits.
Lectures and discussions on current topics in veterinary medicine s as animal disease surveillance, risk analysis, molecular epidemiolo or fish pathology. Targeted at veterinary medicine (DVM) students a other graduate students with a background in veterinary medical sciences.

VMSC 689 Use of Genomics and Proteomics in Infectious Disease (3 credits)
Recommended: BCHM463; and (BSCI330 or BSCI230). Or by Permission. Repeatable to 6 credits if content differs.
Focus is placed on current biotechnological development and recent research breakthroughs in the field of genomics and proteomics as it relates to infectious disease and drug/vaccine development.

VMSC 698 Seminar in Veterinary Medical Science (1-3 credits)
Prerequisite: Permission of AGNR-Veterinary Medicine Program department. Repeatable to 6 credits.
Presentation and discussion of scientific publications, current topics and new methodologies related to veterinary medical sciences.

VMSC 699 Special Problems in Veterinary Medical Sciences (1-4 credits)
Prerequisite: Permission of faculty mentor. Repeatable to 8 credits.
Independent study of a specific problem related to veterinary medicine such as a disease outbreak, application of a new diagnostic test or a risk analysis related to animal health. Targeted at veterinary medicine (DVM) students and other graduate students with a background in veterinary medicine.

VMSC 700 Animal Health Policy and Communication (3 credits)
Recommended: ANSC225 and ANSC340. Restriction: Must be in a major in AGNR-VA-MD Regional Col Veterinary Med; or must be in a major within the AGNR-Animal & Avian Sciences department; or must be in a major in PUAF-School of Public Policy; or permission of AGNR-VA-MD Regional Col Veterinary Med.
An introduction to animal health policy with emphasis on understanding how science and politics interact and influence animal health policy and how veterinarians and animal scientists can effectively communicate science to non-scientists such as legislators and policymakers.

VMSC 705 Genetics of Animal Viruses (2 credits)
An advanced course that covers the structure and complexity of viral genomes, genome replication and expression, virus-host interactions, virus evolution, genetic principles and methodology applicable to animal viruses.

VMSC 720 Viral Pathogenesis (2 credits)
Restriction: Permission of instructor.
This course will teach graduate students about mechanisms of infections by animal and human viral pathogens, including virus-cell interactions, host responses, and consequences of virus infection. Particular attention will be focused on the molecular mechanisms of the interactions between virus and host.

VMSC 760 Immunology of Infectious Diseases (3 credits)
An advanced graduate level course that focuses on the cutting-edge knowledge of immunity and recent research breakthroughs in the interactions between host immune system and infectious pathogen, and vaccine development

VMSC 770 Advanced Topics in Immunology (2 credits)
Prerequisite: VMSC760; or permission of instructor.
The objective of the course is to provide students with the advanced and cutting-edge knowledge and techniques of immunology as well as research advancement in important immunologic topics. A selection of immunology area will be specifically selected with emphasis on recent research breakthroughs in the field. Therefore, the topics will be different each academic year.

VMSC 780 Parasites of Medical and Veterinary Importance (2 credits)
Restriction: Permission of instructor.
Provides students with the basic knowledge of parasites as well as research advancement in important parasites of humans and animals. Particular attention will be given to parasite biology, pathogenesis, and host responses to parasitic infection. A selection of parasites of medical and veterinary importance will be specifically covered with emphasis on recent research breakthroughs in the field.

VMSC 799 Thesis Research (1-6 credits)
Repeatable to 99 credits if content differs.

VMSC 898 Pre-Candidacy Research (1-8 credits)

VMSC 899 Dissertation Research (1-8 credits)
Repeatable to 99 credits if content differs.

Women's Studies (WMST)

WMST 400 Theories of Feminism (3 credits)
Prerequisite: 1 course in WMST; or must have completed a course cross-listed with a WMST course.
A study of the multiplicity of feminist theories which have been developed to explain women's position in the family, the workplace, and society. Major feminist writings are considered in the context of their historical moment and in the context of the intellectual traditions to which they relate.

WMST 408 Literature by Women Before 1800 (3 credits)
Prerequisite: Must have completed two English courses in literature; or permission of ARHU-Women's Studies department. Repeatable to 9 credits if content differs. Also offered as: ENGL408. Credit only granted for: ENGL408 or WMST408.
Selected writings by women in the medieval and early modern era.

WMST 410 Women of the African Diaspora (3 credits)
Explores the lives, experiences, and cultures of women of Africa and the African diaspora--African-America, the Caribbean, and Afro-Latin America. A variety of resources and materials will be used providing a distinctive interdisciplinary perspective.

WMST 420 Asian American Women: The Social Construction of Gender (3 credits)
Also offered as: AAST420. Credit only granted for: AAST420 or WMST420.
Examines the intersection of gender, race and class as it relates to Asian American women in the United States; how institutionalized cultural and social statuses of gender, race, ethnicity and social class, produce and reproduce inequality within the lives of Asian American women.

WMST 425 Gender Roles and Social Institutions (3 credits)
Credit only granted for: SOCY425 or WMST425.
Relationship between gender roles and the structure of one or more social institutions (e.g., the economy, the family, the political system, religion, education). The incorporation of gender roles into social institutions; perpetuation or transformation of sex roles by social institutions; how changing gender roles affect social institutions.

WMST 444 Feminist Critical Theory (3 credits)
Prerequisite: WMST200, WMST250, or ENGL250. Also offered as: ENGL444. Credit only granted for: ENGL444 or WMST444.
Issues in contemporary feminist thought that have particular relevance to textual studies, such as theories of language, literature, culture, interpretation, and identity.

WMST 448 Literature by Women of Color (3 credits)
Prerequisite: Must complete two English courses in literature; or permission of ARHU-Women's Studies department. Repeatable to 9 credits if content differs. Also offered as: ENGL448. Credit only granted for: ENGL448 or WMST448.
Literature by women of color in the United States, Britain, and in colonial and post-colonial countries.

WMST 452 Women in the Media (3 credits)
Also offered as: JOUR452. Credit only granted for: JOUR452 or WMST452.
Participation and portrayal of women in the mass media from colonial to contemporary times.

WMST 453 Victorian Women in England, France, and the United States (3 credits)
Also offered as: HIST493. Credit only granted for: HIST493 or WMST453.
Examines the lives of middle and upper-class women in England, France, and the United States during the Victorian era. Topics include gender roles, work, domesticity, marriage, sexuality, double standards and women's rights.

WMST 454 Women in Africa (3 credits)
Credit only granted for: HIST494 or WMST454.
The place of women in African societies: the role and function of families; institutions such as marriage, birthing, and child rearing; ritual markers in women's lives; women in the workplace; women's associates; women's health issues; measures designed to control women's behavior; women and development.

WMST 455 Women in Medieval Culture and Society (3 credits)
Also offered as: HIST495. Credit only granted for: HIST495 or WMST455.
Medieval women's identity and cultural roles: the condition, rank and rights of medieval women; their access to power; a study of women's writings and the constraints of social constructs upon the female authorial voice; and contemporary assumptions about women.

WMST 456 Women and Society in the Middle East (3 credits)
Recommended: Prior coursework in Middle East studies or gender studies. Also offered as: HIST492. Credit only granted for: HIST492 or WMST456.
Examines the customs, values and institutions that have shaped women's experience in the Middle East in the past and in the contemporary Middle East.

WMST 457 Redefining Gender in the U.S., 1880-1935 (3 credits)
Also offered as: HIST433. Credit only granted for: HIST433 or WMST457.
Exploring changing perceptions of gender in the U.S., 1880-1935, and the impact of those changes on the day to day lives of men and women.

WMST 458 Literature by Women After 1800 (3 credits)
Prerequisite: Must have completed two English courses in literature; or permission of ARHU-Women's Studies department. Repeatable to 9 credits if content differs. Also offered as: ENGL458. Credit only granted for: ENGL458 or WMST458.
Selected writings by women after 1800.

WMST 468 Feminist Cultural Studies (3 credits)
Repeatable to 9 credits if content differs.
Each version of this course focuses on one or several forms of popular culture -- such as TV, music, film, cyber-culture, or genre fiction (for example, science fiction) -- and demonstrates how feminists value, critique and explain such forms. Tools of feminist cultural studies include economic and social analyses of power, race, sexuality, gender, class, nationality, religion, technology, and globalization processes.

WMST 469 Study Abroad Special Topics IV (1-6 credits)
Repeatable to 15 credits if content differs.
Special topics course taken as part of an approved study abroad program.

WMST 471 Women's Health (3 credits)
Restriction: Must be in a major within ARHU-Women's Studies department; or must be in a major within SPHL-Behavioral & Community Health department. Also offered as: HLTH471. Credit only granted for: HLTH471 or WMST471.
The women's health movement from the perspective of consumerism and feminism. The physician-patient relationship in the gynecological and other

medical settings. The gynecological exam, gynecological problems, contraception, abortion, pregnancy, breast and cervical cancer and surgical procedures. Psychological aspects of gynecological concerns.

WMST 488 Senior Seminar (3 credits)
Restriction: Permission of ARHU-Women's Studies department. Repeatable to 9 credits if content differs.
Seminar for advanced majors in women's studies or other students with appropriate preparation. Interdisciplinary topics will vary each semester.

WMST 491 Judaism and the Construction of Gender (3 credits)
Prerequisite: 1 course in JWST; or 1 course in LGBT; or 1 course in WMST. Also offered as: JWST491. Credit only granted for: JWST419X, JWST491, or WMST491.
The study of Jewish culture, religious practice, communal authority, and literature through the frame of such critical categories of analysis as gender, sexuality, masculinity, power, ethics, and the feminine.

WMST 494 Lesbian Communities and Differences (3 credits)
Prerequisite: 1 course in WMST. Recommended: WMST200 or WMST250. Also offered as: LGBT494. Credit only granted for: LGBT494 or WMST494.
The meanings of lesbian communities across many lines of difference. Using lesbian-feminists of the 1970s as a starting point, we will look both back and forward in history, tracing changes and exploring the meanings of these in their social and historical contexts.

WMST 496 African-American Women Filmmakers (3 credits)
Examines the cinematic artistry of African-American women filmmakers and the ways in which these films address the dual and inseparable roles of race and gender.

WMST 498 Advanced Special Topics in Women's Studies (1-3 credits)
Restriction: Permission of ARHU-Women's Studies department. Repeatable to 9 credits if content differs.

WMST 499 Independent Study (1-3 credits)
Prerequisite: 1 course in WMST. Restriction: Permission of ARHU-Women's Studies department. Repeatable to 9 credits if content differs.
Research and writing or specific readings on a topic selected by the student and supervised by a faculty member of the Women's Studies Department.

WMST 601 Approaches to Women's Studies I (3 credits)
Prerequisite: WMST400; or students who have taken courses with comparable content may contact the department.
Examines two fundamental concepts in women's studies: intersectionality and interdisciplinarity. Looks at how feminisms have shaped and been shaped by knowledge-production within and across disciplinary boundaries, cultures, and paradigms. Develops an appreciation of intersectional theory as a critical research tool and as a set of responses to issues of power, domination, oppression and other loci of difference.

WMST 602 Approaches to Women's Studies II (3 credits)
Prerequisite: WMST400; or students who have taken courses with comparable content may contact the department.
Continued examination of intersectionality and interdisciplinarity with emphasis on the politics of knowledge production and identity.

WMST 618 Feminist Pedagogy (3 credits)
Restriction: Permission of ARHU-Women's Studies department.
Examines the higher education classroom from a feminist perspective through theory and analysis. Students are graduate teaching assistants with the Women's Studies department.

WMST 619 Women's Studies Teaching Practicum (1 credits)
Prerequisite: Permission of ARHU-Women's Studies department; and WMST618; and must be a current WMST teaching assistant. Repeatable to 12 credits if content differs.
Provides Women's Studies graduate teaching assistants with ongoing regular faculty supervision during the semesters the students are teaching WMST courses.

WMST 621 Feminist Theories and Women's Movements: Genealogies (3 credits)
Prerequisite: WMST400; or permission of ARHU-Women's Studies department.
Examines theories to explain the matrix of domination from the nineteenth century to the present. Students learn the key debates that produceed new insights and shifted the ground of subsequent feminist theorizing within multi-racial feminisms. Examines those debates within global perspectives. Examines how dominant theoretical frameworks have been developed at specific historical moments.

WMST 628 Women's Studies Colloquium (1 credits)
Repeatable to 12 credits if content differs.
An intensive advanced exploration of current problems and issues in women's studies.

WMST 698 Special Topics in Women's Studies (1-3 credits)
Prerequisite: WMST400; or students who have taken courses with comparable content may contact the department. Repeatable to 6 credits if content differs.
Advanced worik in selected topics in Women's Studies.

WMST 699 Independent Study (1-3 credits)
Restriction: Permission of instructor.
Research and writing on specific readings on a topic selected by the student which is approved and supervised by a faculty member of the Women's Studies Department.

WMST 708 Research Seminar in Women's Studies (3 credits)
Restriction: Permission of instructor. Repeatable to 9 credits if content differs.
This seminar provides an opportunity for those students interested in pursuing feminist research and teaching to synthesize and explore feminist analyses of university life, including research and writing methods, learning styles, curricular issues, and the "chilly climate" for women.

WMST 709 Directed Independent Reading for Major Field Exam (1-4 credits)
Restriction: Permission of ARHU-Women's Studies department.
Directed reading in preparation for Major Field Exam. In consultation with their advisors, students identify, analyze, critique and synthesize material relevant to their major fields of inquiry. Grading will be based on combinations of oral performance in the bi-weekly meetings, production of annotated bibliographies and synthetic papers.

WMST 799 Masters Thesis Research (1-6 credits)
Repeatable to 9 credits.

WMST 898 Pre-Candidacy Research (1-8 credits)

WMST 899 Doctoral Dissertation Research (1-8 credits)
Repeatable to 10 credits if content differs.

Chapter 6: Graduate Faculty

Diker, Vedat Adjunct Member
PhD, SUNY Albany.
- Senior Lecturer, Information Management

Lin, Jimmy Regular Member

- Associate Professor, Information Management

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PhD - University of California, Berkeley 2012 MCP - University of Maryland 2007 BA - Stanford University 2000
- Assistant Professor, Urban Studies and Planning

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- Distinguished University Professor Emeritus, Astronomy
- Research Professor, Astronomy

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- Professor, Engineering: Systems Engineering
- Professor, Engineering: Electrical & Computer Engineering

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- Associate Professor, Neuroscience and Cognitive Science
- Associate Professor, Engineering: Electrical & Computer Engineering

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- Professor, Mathematics

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- Professor, Engineering: Systems Engineering
- Professor, Engineering: Chemical Engineering

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- Professor, Education: Curriculum and Instruction

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- Assistant Professor, Education: Teaching and Learning, Policy and Leadership
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- Assistant Professor, Information Studies

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- Professor, Chemical Physics
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- Division Director, Mechanical & Structural Systems, NSF

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- Associate Professor, Engineering: Civil and Environmental Engineering
- Associate Professor, Engineering: Systems Engineering

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MCP - University Pennsylvania M Arch - University Pennsylvania M Arch - University of Cape Town B Arch - University of Cape Town
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- Professor, Engineering: Mechanical Engineering

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Please see our departmental website for our faculty lists: Faculty:http://www.hesp.umd.edu/facultygroup/Faculty Clinical Supervisors:http://www.hesp.umd.edu/clinicalfaculty Adjunct Faculty:http://www.hesp.umd.edu/facultygroup/Adjunct%2520Faculty Graduate Faculty Status: Non-Member
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- Distinguished Scholar-Teacher, Physics
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- Associate Professor, Applied Mathematics & Statistics, and Scientific Computation
- Associate Professor, Mathematics

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- Associate Research Scholar, Philosophy and Public Policy, Institute for

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- Professor, Engineering: Materials Science and Engineering
- Professor, Engineering: Chemical Engineering

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- Associate Dean, College of Agriculture and Natural Resources
- Associate Director, Cooperative Extension Service
- Associate Professor, College of Agriculture and Natural Resources
- Associate Professor, Cooperative Extension Service

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- Research Associate, Substance Abuse Research, Center for

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Waks, Edo Regular Member
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- Associate Professor, Engineering: Electrical & Computer Engineering
- Affiliate Associate Professor, Physics

Waks, Leah Adjunct Member
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- Senior Lecturer, Communication

Walker, Leslie Regular Member
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- Clinical Assistant Professor, Education: Teaching and Learning, Policy and Leadership

Walker, Richard E. Regular Member
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- Associate Professor Emeritus, German Literature and Language

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- Chair, Geology

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- Research Professor, Applied Mathematics & Statistics, and Scientific Computation
- Research Professor, Physics

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- Professor, Economics

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- Professor, Plant Science

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- Assistant Professor, Systems Research, Institute for

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- Professor Emeritus, Library Science

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- Professor, Afro-American Studies

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- Professor, Chemistry

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- Engineer, APL, The Johns Hopkins University

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- Associate Professor, Biological Sciences
- Associate Professor, Neuroscience and Cognitive Science
- Associate Professor, Entomology

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- Professor, Education: Human Development

Wang, Min Qi Regular Member
Ed.D., Syracuse University; B.S., M.S., The City College of New York
- Professor, Public Health: Behavioral and Community Health Ph.D.
- Professor, Public Health: Master of Public Health--Behavioral and Community Health

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- Professor, Comparative Literature
- Affiliate Associate Professor, American Studies

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- Associate Professor, History/Library

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- Associate Professor, Information Management
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- Assistant Professor, Chemical Physics
- Assistant Professor, Chemistry and Biochemistry

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- Assistant Professor, Government and Politics

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- Associate Director, Music
- Associate Professor, Music

Warner, C. Robert Regular Member
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- Associate Professor Emeritus, Mathematics

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- Professor Emerita, Dance

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- Senior Agent, Cooperative Extension Service
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- Distinguished Scholar-Teacher, Mathematics
- Professor, Applied Mathematics & Statistics, and Scientific Computation
- Professor, Mathematics

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- Affiliate Professor, Women's Studies
- Affiliate Professor, American Studies

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- Associate Research Scholar, Philosophy and Public Policy, Institute for

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- Adjunct Professor, Higher Education, Student Affairs and International Education Policy

Watters, Thomas Special Member
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- University Affiliate, Geology

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- Lecturer, Information Management
- Lecturer, Information Studies

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Atheneum B, Thorbecke Lyceum, The Hague, Netherlands, 1975; MS.C., Biomathematics, University of Leiden, Netherlands, 1981; M.A. Business Management, University of Delft, Netherlands, 1980; MS.C. Statistics, Netherlands Society for Statistics and Operations, 1986; Ph.D. Marketing, University of Wageningen, Netherlands, 1990.
- Professor, Applied Mathematics & Statistics, and Scientific Computation

Weeks, Ann C. Adjunct Member
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- Associate Dean, Information Studies
- Associate Dean, History/Library Science
- Associate Dean, Library Science

Weeks, John D. Regular Member
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- Distinguished University Professor, Chemical Physics
- Distinguished University Professor, Chemistry
- Distinguished University Professor, Biophysics
- Affiliate Professor, Physics

Weible, Thomas Donald, Jr. Regular Member
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- Associate Dean, College of Education

Weil, Raymond R. Regular Member
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- Professor, Environmental Science and Technology

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- Professor, Neuroscience and Cognitive Science
- Professor, Linguistics
- Associate Professor, Advanced Computer Studies, Institute for
- Affiliate Professor, Computer Science

Weiner, Joshua Regular Member
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- Associate Director, Creative Writing
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- Associate Professor, Creative Writing

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- Professor Emeritus, Biological Sciences

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- Senior Research Scientist, Advanced Computer Studies, Institute for

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- Professor Emeritus, Criminology and Criminal Justice

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- Senior Agent, Cooperative Extension

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- Senior Agent, 4-H Youth Development

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- Professor, Engineering: Electrical & Computer Engineering
- Professor, Physics

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- Professor, Mathematics

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- Professor, Education: Human Development

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B.E., McGill University-Montreal,1983; M.S., Massachusetts Institute of Technology, 1987; Ph.D., 1990.
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- Instructor, Family Science
- Instructor, Couple and Family Therapy, M.S.

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- Assistant Professor, Psychology

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- Adjunct Professor, History/Library Science

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B.Mus., University of Michigan-Ann Arbor, 1963;M.A., New York University, 1969; Ph.D., 1974.
- Professor, Music

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- Professor, Art History and Archaeology

Whigham, Dennis Special Member
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- University Affiliate, Environmental Science and Technology

White, Ian Regular Member
Ph.D., Stanford University 2002
- Associate Chair, Engineering: Bioengineering
- Associate Professor, Engineering: Bioengineering
- Associate Professor, Fischell Department of Bioengineering
- Assistant Professor, Chemical Physics

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- Adjunct Professor, Biological Sciences

White, Susan Regular Member
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- Lecturer, Business and Management

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Ph.D. (1976), and M.S. (1969), University of Pittsburgh; B.A. (1965), Shaw University
- Professor Emeritus, Anthropology

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BA, Education, Pädagogische Hochschule Rorschach, Switzerland (1981); Nikolais/Louis Dance Lab, New York City (1984-87); Alexander Technique/Somatic Training, Regina Wray, Ann Rodiger (1986-96)
- Associate Professor, Dance

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DPhil, Universität Bonn, 2003
- Associate Professor, History
- Affiliate Associate Professor, Jewish Studies

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- Professor, Education: Human Development

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- Assistant Professor, Information Studies

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- Head, Reproductive Physiology, National Zoological Park

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- Distinguished Scholar-Teacher, Government and Politics
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- Professor, Biological Sciences

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B.B.A., West Texas State University, 1990; M.A., University of Oklahoma, 1992; M.S.B.A., Washington University in Saint Louis, 1994; Ph.D., Washington University in Saint Louis, 1996.

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- Associate Professor, Linguistics
- Associate Professor, Philosophy
- University Affiliate, Philosophy

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Ph.D. University of Chicago 1987 - NIST
- University Affiliate, Chemical Physics

Williams, Carl Regular Member
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AB, Princeton University, 1989; MA, Stanford University, 1991; PhD, Stanford University, 1995
- Associate Professor, History

Williams, Edith C. Regular Member
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- Specialist, Cooperative Extension Service
- Specialist, 4-H Youth Development

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- Distinguished University Professor, Physics
- Distinguished University Professor, Chemical Physics

Williams, Helen D. Regular Member
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- Professor, Agricultural and Resource Economics

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- Chair, American Studies
- Associate Professor, American Studies
- Affiliate Associate Professor, Women's Studies
- Affiliate Assistant Professor, American Studies

Willis, Gordon Regular Member
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- Adjunct Associate Professor, Survey Methodology

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- Agent, Extension Service Cecil

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- University Affiliate, Applied Economics
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- Assistant Professor, Materials and Nuclear Engineering

Wilson, Sacoby Regular Member
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- Assistant Professor, Public Health: Master of Public Health--Environmental Health Sciences

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- Associate Professor, Engineering: Aerospace Engineering

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- Associate Professor, Mathematics

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- Lecturer, Information Management
- Lecturer, Library Science
- Lecturer, History/Library Science

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- Professor Emeritus, English Language and Literature

Wiseman, Donna Regular Member
B.S., Oklahoma State University, 1968; M.Ed., Arkansas State University, 1976; Ph.D., University of Missouri-Columbia, 1979.
- Dean, Education: Curriculum and Instruction
- Dean, Education: Teaching and Learning, Policy and Leadership
- Professor, Education: Curriculum and Instruction
- Professor, Education: Teaching and Learning, Policy and Leadership

Wish, Eric D. Regular Member
B.S., University of Massachusetts-Amherst, 1968; Ph.D., Washington University, 1977.
- Director, Substance Abuse Research, Center for
- Associate Professor, Substance Abuse Research, Center for
- Associate Professor, Criminology and Criminal Justice

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- Professor, Music

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B.A., University of Maryland, Baltimore County, 2004; M.A., University of North Carolina at Chapel Hill, 2006; Ph.D., University of North Carolina at Chapel Hill, 2010.
- Assistant Professor, Government and Politics

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- Professor Emeritus, Mathematics

Wolniak, Stephen M. Regular Member
B.A., State University of New York-Oswego, 1972; M.S., University of Illinois-Urbana/Champaign, 1974; Ph.D.,University of California-Berkeley, 1979.
- Professor, Biological Sciences

Wolpert, Scott A. Regular Member
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- Associate Dean, College of Computer, Mathematical, and Physical Sciences
- Chair, Mathematics
- Distinguished Scholar-Teacher, Mathematics
- Professor, Mathematics

Wolvin, Andrew D. Regular Member
B.S., University of Nebraska, 1962; M.A.,1963; Ph.D., Purdue University, 1968.
- Professor, Communication

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B.S., Federal City College, 1975; M.S., Trinity College, 1980.
- Senior Agent, Extension Service Charles

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- Professor, American Studies
- Affiliate Professor, Women's Studies

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- Assistant Professor, Afro-American Studies

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- Assistant Professor, History

Woods, L. Curry, III Regular Member
B.S., Murray State University, 1975; M.S., Ohio State University-Columbus, 1977; Ph.D., North Carolina State University, 1983.
- Associate Professor, Animal Sciences

Worthington, Roger L Regular Member
A.A., Fullerton Community College, 1984; B.A., California State University, 1987, cum laude; M.A., University of California, 1990; Ph.D., University of California, 1995
- Chair, Education: Counseling Psychology, School Psychology, and Counselor Education
- Professor, Education: Counseling Psychology, School Psychology, and Counselor Education

Wrenn, Jerry P. Regular Member
B.S., East Carolina University-Greenville, 1961; M.S., University of Tennessee-Knoxville, 1963; Ph.D.,University of Maryland-College Park, 1970.
- Associate Professor Emeritus, Kinesiology

Wright, Richard Adjunct Member
B.S., Syracuse University, 1953; M.S., Syracuse University, 1955; Ph.D., University of Illinois, 1962.
- Research Professor, Engineering: Civil and Environmental Engineering

Wu, Louisa Regular Member
Ph.D. University of California, San Diego, 1995
- Associate Professor, Cell Biology and Molecular Genetics
- Affiliate Professor, Biological Sciences
- Affiliate Associate Professor, Entomology

Wu, Min Regular Member
B.A., Tsinghua University/Qinghua University, 1996; B. Elect. Eng., 1996; M.A., Princeton University, 1998; Ph.D., 2001
- Professor, Engineering: Electrical & Computer Engineering

Wuttig, Manfred R. Regular Member
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- Professor, Engineering: Materials Science and Engineering

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B.A., Yale University, 1970 Ph.D., University of California-Berkeley, 1975.
- Professor, English Language and Literature

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